The Electrical Industry's Weekly Magazine

April 7, 1958

Electrical World

Price 50 Cents

A McGraw-Hill Publication

A 10-Page Feature: Distribution for

Shopping Centers ..... page 69

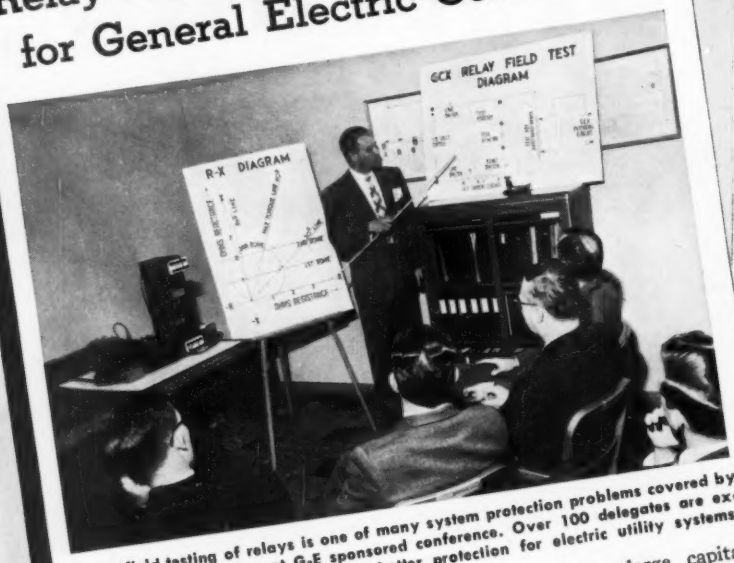
REGIONAL REPORT ON PACIFIC NORTHWEST:

Progress, Partnership, Politics . . . page 66

E B POWER GS W
UNIVERSITY MICROFILMS IN
313 N 1 ST
ANN ARBOR MICH

Philadelphia, March 10, 1958...

Relay experts in Philadelphia for General Electric Conference



Better field testing of relays is one of many system protection problems covered by small discussion groups at G-E sponsored conference. Over 100 delegates are exchanging ideas on how to provide better protection for electric utility systems.

PHILADELPHIA, PA., MARCH 10—The first of two week-long technical sessions dealing with electrical relays opened today at the Penn-Sherwood Hotel. Some 114 relay experts representing producers of about three-fourths of the nation's electric power are attending the symposium sponsored by the General Electric Co. "Planning Protection for Tomorrow's Systems" is the conference theme.

Small group discussions will continue through Friday afternoon, led by specialists from General Electric's Low Voltage Switchgear Dept. in Philadelphia, the Electric Utility Engineering Section in Schenectady, N. Y., and Communication Products Dept., Syracuse, N. Y. Delegates will also tour G-E switchgear manufacturing and laboratory facilities and see a demonstration of new carrier-current and microwave relaying.

Relays detect any abnormal performance on a power system and initiate corrective action. Designing relay systems is considered a special science in the field of electrical engineering. The planning of a huge power system costing millions of dollars is vitally affected by how efficiently it can be protected by relaying. Sometimes large capital savings can be achieved by changing the design of the relay system at a fraction of the cost of the main power equipment.

"Planning Protection for Tomorrow's Systems"

Relay specialists pool their knowledge to plan improved system protection

With the trend to heavy loading of transmission lines and the growing demand for increased service continuity, the search for better relaying becomes vitally important. Conducted as a series of small group discussions, these General Electric sponsored engineering conferences permit an interchange of ideas, experiences and opinions on relays, methods and practices. Recognized protection problems in various power system areas are discussed, and conferees evaluate possible solutions. Sharing the collective contributions of knowledge between utility and General Electric relay specialists will result in better protection of the modern power system. General Electric Co., Schenectady 5, N.Y.

301-380

MORE POWER TO AMERICA

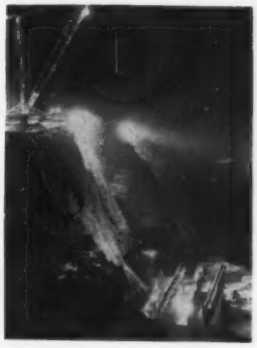
GENERAL ELECTRIC

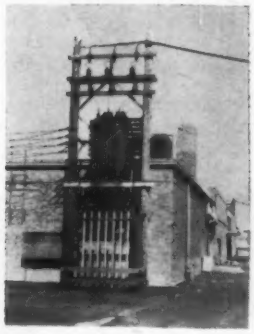
Electrical World

Vol. 149, No. 14 APRIL 7, 1958

Published for 84 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

In This Week's Issue





CURRENT EVENTS

Report on Pacific Northwest

Construction pushes ahead as feuds smoulder: fish vs dams, preference, the true meaning of partnership.....p 66

SPECIAL FEATURE

Distribution for Shopping Centers

An introduction to the series of articles distills combined planning experience of four utilities.....p 69

Chicago Varies Supply Schemes

W. R. Zimmerman, Commonwealth Edison Co

Primary voltages of 4, 12, or 34.5 kv serve large shopping centers. Aerial cable or underground used.....p 70

Detroit Edison Uses 3 Methods

W. E. Groves, Detroit Edison Co

Underground for largest; overhead circuits with transformers on roofs for others; but conventional for most.....p 73

Vepco Prefers Overhead

R. C. Daffron, Virginia Electric & Power Co

Pole line is usually located in alley. For underground, the owner pays for vaults, manholes, conduit lines.....p 75

Serves 12,000-Kva Load Underground

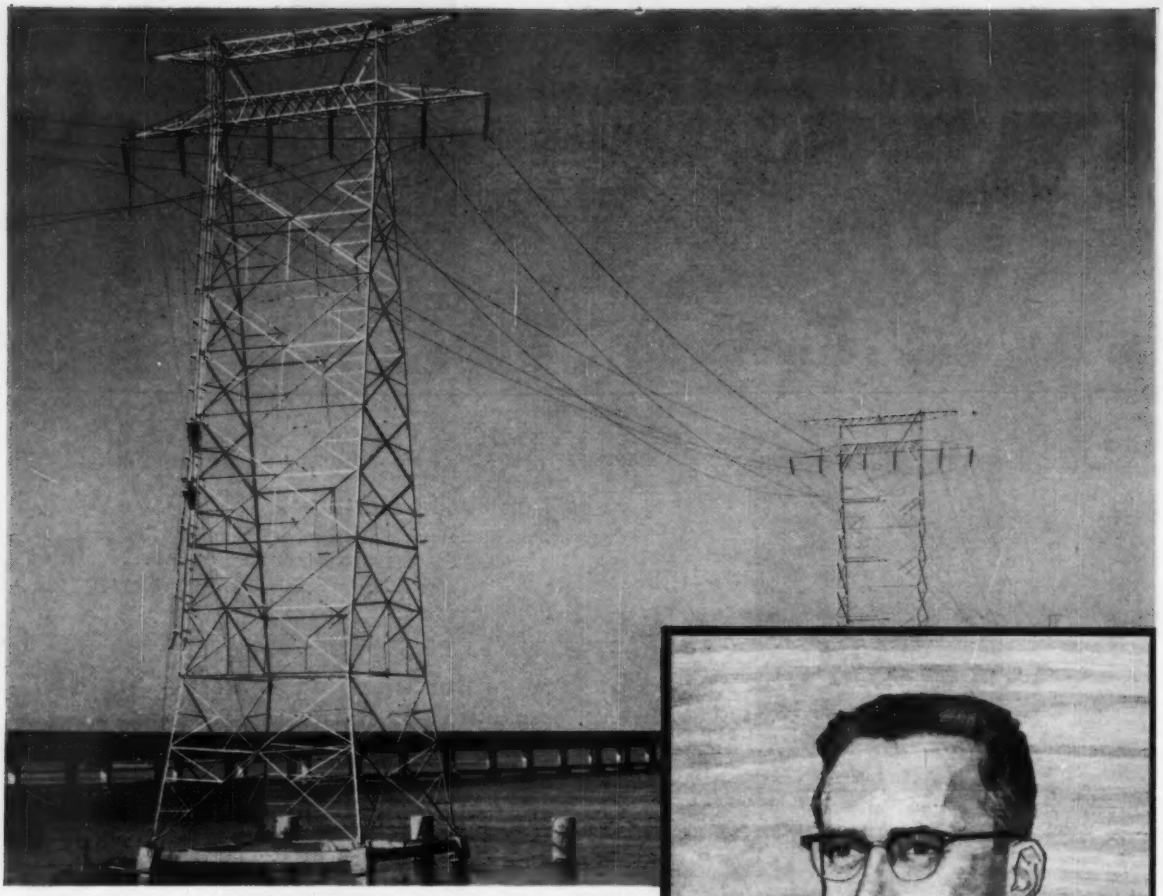
R. M. Grogan, Long Island Lighting Co

Primary supply at 13.2 kv in steel and concrete conduit supplies 120/208-v secondary services.....p 77

Departments

Atomic Progress 64
Books 143
Editorial 61
• Electrical Newsletter 19
Engineering Reference Sheet 90
Executive Reader 22
From the Publisher 5
How To 82
• Management Newsletter ...123
Manufacturers News 95
Meetings Calendar 144
New Equipment 104
News About People 136
Readers Forum 146
Selling 131
Washington Wire 62

INDEX TO ADVERTISERS...146



CLYDE F. MOONEY, PRESIDENT

This was the problem in Houston . . . This is how Anchor helped solve it

The Houston Lighting & Power Company was building a major transmission line to the island city of Galveston. Crossing the Intracoastal Waterway presented a problem in transmission tower design: make them high enough to provide clearance for ships, yet not so tall as to present a hazard to aircraft.

Anchor Metals, working closely with Houston Lighting & Power Company engineers, helped design towers to meet the unusual requirements.

In approximately one month, the special towers were detailed, fabricated and shipped. And Houston Lighting & Power Company was able to continue its expansion program without serious delay in construction.

At Anchor, service and quality is the slide rule of every operation.

ANCHOR METALS INC.

HURST, TEXAS • FORT MADISON, IOWA

Management News Reported in Depth

As you have noted in our Management Newsletter (p 123) this year, we are striving to put the week-to-week management news in terms of its broad significance to you. We are sifting out the trivial, digging deep for the necessary background and news that will offer management subjects in a form that will make your reading time more profitable.

The incisive report on use of accelerated depreciation (EW, Feb. 10, p 97) did more than just present a plan for use of this tax accounting method. It also offered the background necessary to grasp the complex subject.

Other reports on rates, employee relations, public relations, energy cost estimates for nuclear plants have also sought to point up trends, spotlight useable information, as well as report current developments in these fields.

This reporting in depth contrasts sharply with the bare news items which previously occupied much of the Management Newsletter space.

It is our hope and our belief that this new form of presentation serves the busy executive better than the former way, and also offers an effective training aid for those of you who are striving to enter the higher management ranks.

Fischer Black

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Published weekly by McGraw-Hill Publishing Co., Inc., James H. McGraw (1860-1948), Founder. **Executive, Editorial, Circulation and Advertising Offices:** McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y. Printed at 99-129 North Broadway, Albany 1, N. Y. See panel at right for circulation regarding subscriptions or change of address.

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Subscriptions are solicited from executive, supervisory, and engineering personnel in electric utilities, manufacturing companies, and related fields; and from consulting engineers and electrical engineers in industry. Position and company connection must be indicated on subscription orders. Send to address shown in box at right.

United States and Canada subscription rate for individuals in the field of the publication $6.00 per year; single copies 50 cents. Other Western Hemisphere and the Philippines $30.00 payable in advance and other countries $30.00 payable in advance.

Second-class mail privileges authorized at Albany, N. Y. Printed in U.S.A. Title registered in U. S. Patent Office.

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765 YEARS

W. E. HENGES
President
Started in 1913 as Receiving Clerk

R. B. SAYRE
Vice President
Started in 1921 as Warehouseman

J. REINE
Vice President
Started in 1927 as Warehouseman

ready to serve you!

Experienced men make an experienced organization — one that can be relied on to serve you well.

Graybar, oldest and largest independent distributor of "everything electrical," has long proved the soundness of this principle by continually filling key company posts from within. All Graybar officers and district managers began "in the ranks."

The result? An experienced, close-knit management group who — as clerks, office boys, and salesmen — *themselves* helped build the foundation for Graybar's ever-growing list of customers.

It's easy, then, to see why — with the same opportunities for advancement — each and every Graybar employee has a powerful incentive to do his job well.

Moreover, Graybar is totally owned by its operating and retired personnel. That's another reason why every Graybar employee is personally interested in meeting your electrical needs accurately, helpfully, and as rapidly as possible.

Graybar Electric Company, Inc., Executive Offices: Graybar Building, New York 17, N. Y.

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District Mgr., New York
Started in 1933
as Salesman

E. E. MARTIN
District Mgr., Boston
Started in 1920
in Student Course

J. E. CARROLL
District Mgr., Pittsburgh
Started in 1935
as Salesman

D. A. WILLIAMS
District Mgr., Detroit
Started in 1936
as Warehouseman

100,000 first-quality electrical items are distributed throughout the nation . . .

GRAYBAR . . . THE LARGEST DISTRIBUTOR

# of electrical experience

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Vice President
Started in 1922 as Assistant Accountant

A. C. LAMPERTI
Comptroller
Started in 1920 as Bookkeeper

F. E. GIBSON
Treasurer
Started in 1920 as Service & Claims Clerk

W. J. GOERISCH
District Mgr., Philadelphia
Started in 1929 as Manager, Power Apparatus Sales

W. J. BERRY
District Mgr., Richmond
Started in 1937 as Salesman

J. E. FONTAINE
District Mgr., Atlanta
Started in 1928 as Warehouseman

D. L. HARPER
District Mgr., Tampa
Started in 1933 as Salesman

E. P. JONES
District Mgr., Cleveland
Started in 1937 in Student Course

H. G. COOK
District Mgr., Cincinnati
Started in 1920 as Messenger

C. E. KIRKPATRICK
District Mgr., Chicago
Started in 1936 in Office Sales

N. W. ZILCH
District Mgr., Minneapolis
Started in 1934 as Serviceman

M. P. JOHNS
District Mgr., St. Louis
Started in 1939 as Salesman

W. FRAZIER
District Mgr., Kansas City
Started in 1911 as Office Boy

V. A. ELMBLAD
District Mgr., Dallas
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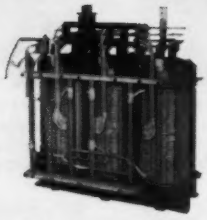
District Mgr., Los Angeles
Started in 1928 as Salesman

J. P. LAWTON
District Mgr., Seattle
Started in 1923 as Warehouseman

OF ELECTRICAL SUPPLIES IN THE WORLD

Helping

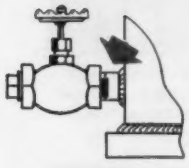


Compact, low-loss design

Thermal capacities are high for contingency load conditions. Sturdy, time-proved core and coil construction adequately meets repeated short-circuit stresses of network operation.

Safe, dependable tap-changing mechanism

Handle inserted through two-inch opening in cover operates mechanism. Handle cannot be removed unless the tap changer is in a positive position.



Threaded valve connections

Connections are solder wiped for extra protection. Valves located for easy access. Globe-type valves with non-rotating seats close tight, avoid wear on valve seats.

Special design of bushing seal

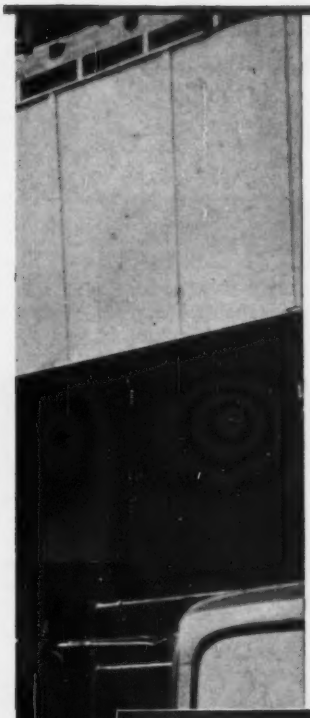
Spiral-wound metallic gaskets actually adjust to changing operating conditions. Gaskets can be installed without grease or cement. May be re-used if necessary.

Flexibility in Choice—To simplify application problems, Allis-Chalmers network transformers are available in all three types — oil filled, *Chlorextol* liquid filled, and sealed dry type.

ALLIS-

Meeting Growing System Needs
...in city after city

Newark Grow!



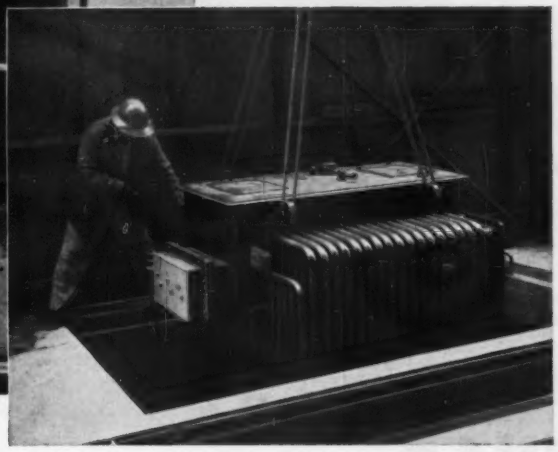
Symbolizing a wholesome optimism, reflected throughout America, is the new cloud-nudging Mutual Benefit Life Insurance Building in progressive Newark, N. J. Along with Newark's healthy growth came the inevitable load concentration growing pains—a condition that has been aided by the installation of two Allis-Chalmers 2000-kva network transformers.

Linked into the *Public Service Electric and Gas Company's* network system, these Allis-Chalmers units are helping to meet increased load demands of power, lighting and air conditioning. Compact design, rugged construction, conveniently located accessories, high thermal capacities, protection against corrosion and flooding — these features make A-C units the logical choice.

Two Million Kva in Operation

This installation has pushed Allis-Chalmers operating kva near the two million mark. When you consider your next network installation, it will pay you to investigate the reasons why Allis-Chalmers transformers are high on the preference list of utilities everywhere. Get all the facts. Call your nearby A-C district office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Chlorextol is an Allis-Chalmers trademark.



CHALMERS

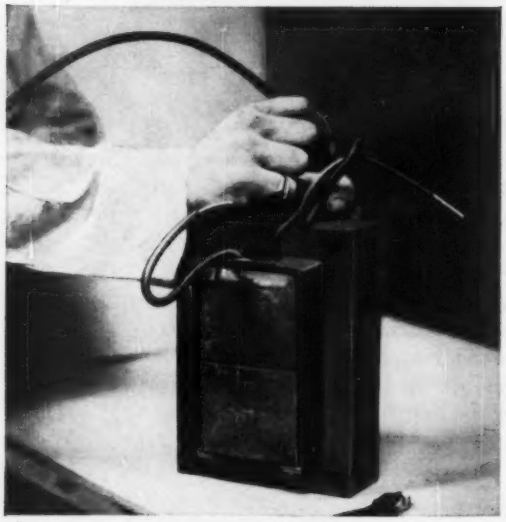
A-C ALLIS-CHALMERS

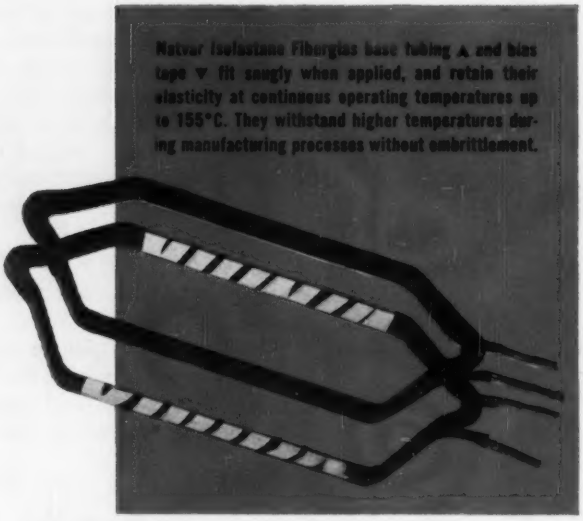
A-5439

NATVAR ISOLASTANE* TUBING and TAPE

✓ **RESILIENT, ELASTIC** – for sharp bends and irregular surfaces

✓ **HEAT RESISTANT** —for continuous performance at temperatures up to 155°C





Natvar Isolastane Fiberglas base tubing A and bias tape V fit snugly when applied, and retain their elasticity at continuous operating temperatures up to 155°C. They withstand higher temperatures during manufacturing processes without embrittlement.

*ISOLASTANE *is Natvar's new elastomeric isocyanate type coating for Fiberglas braid and tape. Registration pending.*

Natvar Isolastane is now making important savings possible. It makes it unnecessary to use expensive Class H materials to solve temperature problems during the manufacture of products which do not require Class H rating.

Isolastane is outstanding in its

- *ELASTICITY (EXTENSIBILITY)*
- *RESISTANCE TO HEAT*
- *RESISTANCE TO CRAZING AND CRACKING*
- *RESISTANCE TO SOLVENTS, INCLUDING THE ASKARELS*
- *TOUGHNESS AND ABRASION RESISTANCE*
- *WET DIELECTRIC STRENGTH*
- *LOW TEMPERATURE FLEXIBILITY*
- *FUNGISTATIC QUALITIES*

Full technical data and samples are available on request.

Natvar

Natvar Products

- Varnished cambric—cloth and tape
- Varnished canvas and duck
- Varnished silk and special rayon
- Varnished—Silicone coated Fiberglas
- Varnished papers—rope and kraft
- Slot cell combinations, Aboglas®
- Isoglas® sheet and tape
- Isolastane® sheet, tape, tubing and sleeving
- Vinyl coated—varnished tubing and sleeving
- Extruded vinyl tubing and tape
- Styroflex® flexible polystyrene tape
- Extruded identification markers

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AN IDEA PIONEERED BY

DUNCAN

Duncan pioneered the Class 200 rating with the "Extended Range" Type MF-SE meter introduced eight years ago. This "50 amp" singlephase meter provided capacity to 200 amps. Within two years, Duncan also made 200 amp "extended range" capacity available in the Type MH polyphase meter.

TYPE MF-SE (1949)

CLASS 200 RATINGS

for More "Housepower!"

30 AMP.

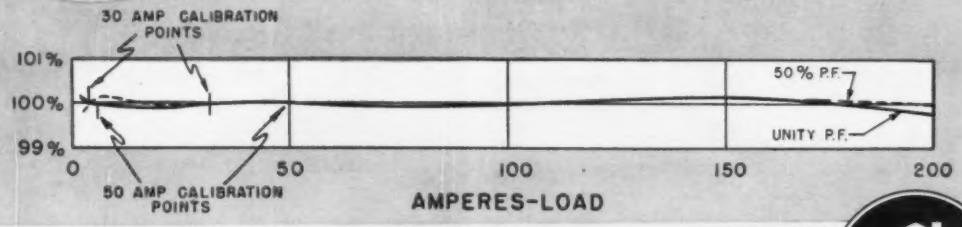
50 AMP.

TYPE MK

The Duncan Type MK Class 200 meter is the latest of the improved singlephase MK line, built to accurately meter a wide range of loads from a few watts to the meter's full 200 ampere capacity. Arc-resistant insulation in the electromagnet, self-contained arc gaps to by-pass electrical disturbances, and Alnico V permanent magnets to maintain calibration stability are just a few of the MK features in this meter.

This meter also offers excellent performance. Note the "straight line" load curves in diagram below. Meters are available with test ampere ratings of both 30 and 50 amperes, starting watts 24 and 36, respectively.

Duncan offers "Meters to Meet Your Requirements", with field engineers and representatives serving all areas of the country. Quick delivery from finished stocks. TRY DUNCAN SERVICE!

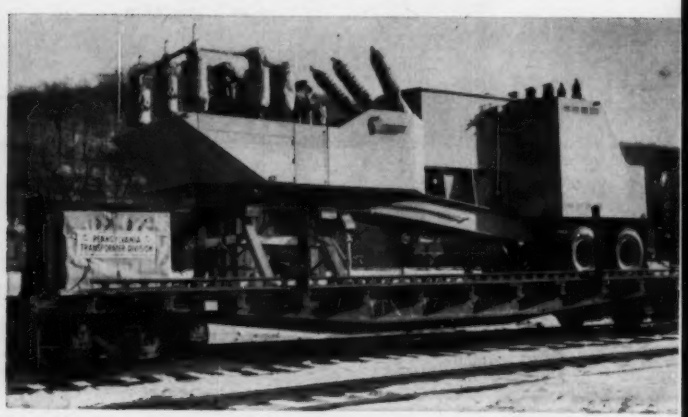


DUNCAN ELECTRIC CO., INC., LAFAYETTE, INDIANA

LIVE BETTER ELECTRICALLY WITH FULL HOUSEPOWER

NEW 15000 KVA PENNSYLVANIA

The rear compartment and platform of Pennsylvania's new Transmobile provide easy access to the low voltage circuit breaker, control equipment, metering devices, etc.



Shipped by rail, the Transmobile was unloaded by backing a tractor under the trailer and driving it down a ramp. The 15000-kva unit was shipped fully assembled.

MOBILE SUBSTATION meets normal highway clearances . . .

Pennsylvania "Transmobile" speeds complete substation service wherever it's needed

One of the highest-capacity mobile substations in the United States now rolls over the highways of a southwestern utility to wherever it is needed for emergency or maintenance service. This substation on wheels, a new Pennsylvania Transmobile, also serves as a replacement unit for the utility whenever permanent facilities are being altered or enlarged.

Designed and built by Pennsylvania Transformer, the three-phase, 15,000-kva Transmobile has a high voltage of 64,400△ volts, with two full-capacity taps above and two below normal. The low voltage is 12,470Y/7200 volts.

The substation includes a high voltage air-break switch, which is retractable when the Transmobile is being moved, high voltage and low voltage lightning arresters, metering and auxiliary power transformers, metering current transformers, a low voltage oil circuit breaker, a phasing transformer, and high voltage fuses.

Mobility of the Pennsylvania Transmobile is excellent, despite its high capacity and complete complement of substation equipment. With high voltage fuses removed, all three dimensions meet normal highway clearances. Only the weight exceeds normal highway limitations—but the total weight is well within the maximum agreed upon between the utility and the state.

Pennsylvania Produces All Types and Sizes of Custom-Designed Mobile Substations

Putting power on wheels is nothing new for Pennsylvania Transformer, whose experience with mobile units ranges from small distribution transformers to fully equipped substations like the one shown. A 15,000-kva mobile autotransformer (138—69 kv) is now under construction for the same southwestern utility.

If you are considering adding mobility to your own system, a consultation with Pennsylvania's experienced engineers will not obligate you in any way. Contact Pennsylvania Transformer Division, McGraw-Edison Company, Box 330, Canonsburg, Pa.

POWER TRANSFORMERS

5000 KVA PENNSYLVANIA MOBILE SUBSTATION
High voltage: 11500△ x 34500 volts. Low voltage: 2520/4360Y/2520 x 7560/13090Y/7560 volts.

3750 KVA PENNSYLVANIA MOBILE SUBSTATION
High voltage: 25700 x 51400△ volts. Low voltage: 2520/4360Y/2520 x 5040/8720Y/5040 x 7560/13090Y/ 7560 volts.

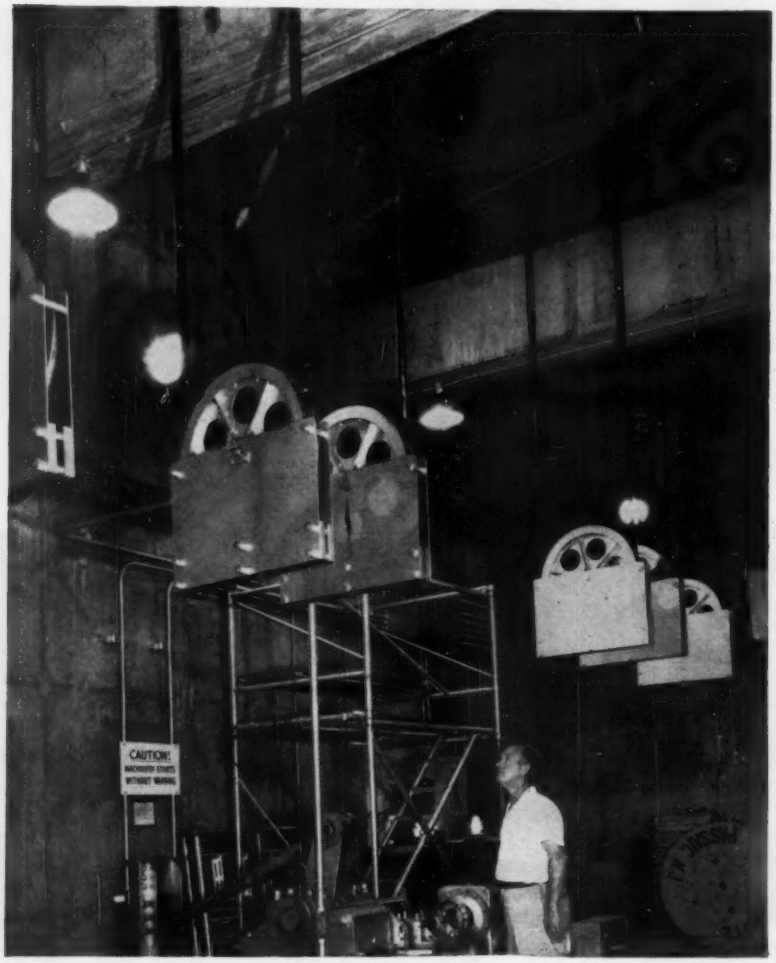
OKONITE cables

Electric power and control cables for lift bridge installed in unique manner... demanding Okocord engineered-to-last constructions

When Sverdrup & Parcel, one of America's leading architectural-engineering firms, designed the new Sidney Lanier Bridge in Brunswick, Georgia, for the Georgia State Highway Department, they discovered that they were faced with an electric cable problem that called for some imaginative thinking.

Briefly, the 250-foot lift span on the new structure was to be hoisted by synchronized motors in both towers which had to be linked with power and control cables. The question was—*where to locate the cables?*

Go over the bridge? Not only would that increase the loading on the bridge towers (to get proper sagging tensions) but aerial cables would materially detract from the clean, modern look of the handsome structure.



Go under the bridge? The river bed at this point consists of clean-swept shale with swift currents and reversing tidal effects. To lay cable on or under the bottom or in pipes would be extremely difficult and expensive, making replacement after normal service uneconomical.

Through the middle, then, was the best solution. Run the cables right through the span itself, a span that would be constantly moving up and down over a distance of 115 feet. To take up the cable slack, an ingenious system of sheaves and counterweights was designed for installation in the towers, just below roadway level. From these, the necessary cable would be payed out as the span rose . . . would be reeled in as the span descended.

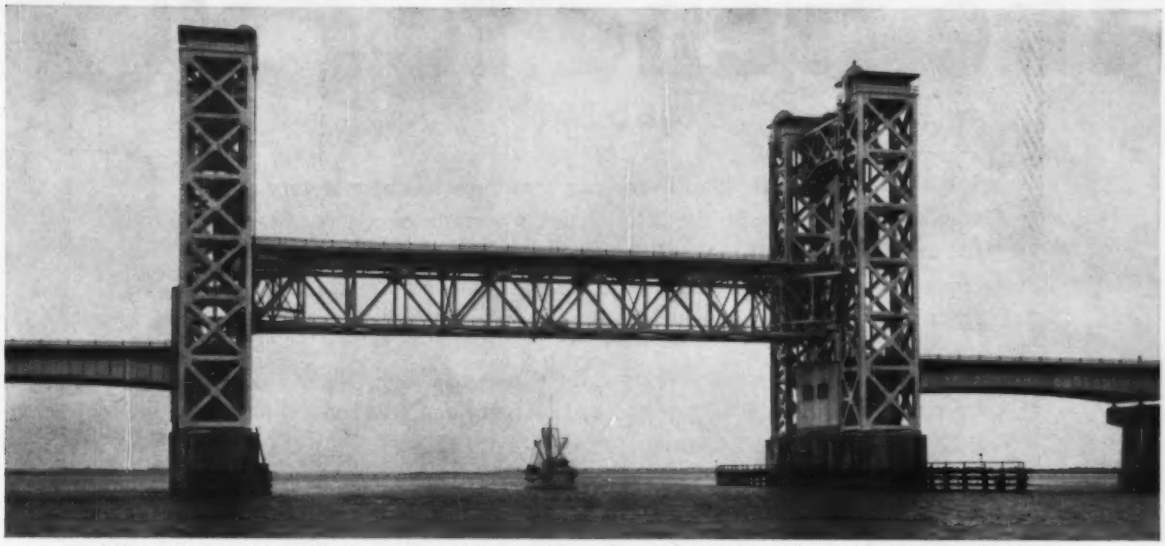
Needed: *a strong, flexible, long-lived cable*

To make this plan work, however, unusual—perhaps unique—cable was needed. It had to have utmost flexibility to absorb the constant reeling and re-reeling under tension as the span moved up and down. It had to be unusually strong, for the height of the lift, combined with the counterweighting and wind load, would give a pull equivalent to 500 feet of cable. And, finally, it had to be capable of resisting repeated exposure to sunlight, heat, high humidity and corrosive salt spray.

←

2700 times a year these sheaves and counterweights go into action, paying out Okocord power and control cables as the bridge span is raised . . . reeling them in as the bridge is opened to traffic again. Designers specified Okocord to withstand the tension, sharp bends and constant flexing of this service.

bring the big ones to life



A 250-foot lift span, weighing well over one thousand tons, is raised by Okocord power and control cables to pass a shrimp boat under the new Sidney Lanier Bridge across Turtle River in Brunswick, Georgia. Designers, Sverdrup & Parcel; J. E. Greiner Co. and Associates, consultants; Georgia State Highway Department, supervisory engineers; electrical contractors, Harrison's Service of Brunswick. The unusual lifting mechanism is wired with more than ¾ of a mile of tough, flexible Okocord cables.

Why Okocord was picked

After various designs and estimates had been submitted, the Okocord constructions recommended by Okonite engineers got the nod. Interesting features of these cables were the steel rope core for reinforcing the multi-conductor control cable and the high moisture resistance of Okonite's insulation. Also, Okonite was able to point to at least two other Okocord installations in which similar conditions of environment, tension and mechanical action had been successfully met.

Installed more than a year ago, these Okocord cables have successfully brought the big Sidney Lanier Bridge to life. And engineers estimate that service life will at least equal a far more expensive submarine installation.

If your operation involves portable or flexible cable, write for Bulletin EW-1108 and find out how rugged, dependable Okocord can save time, replacement costs and down time losses. In fact, whatever your cable needs, when you talk to Okonite, you get unprejudiced recommendations, because Okonite, and *only* Okonite, makes cable by all four insulating methods: strip, dip, extrusion and taping. The Okonite Company, Passaic, New Jersey.

Vital links that control and power the bridge's motors, lights, alarms and gates are these three Okocord cables. Two lengths of each are used on either end of the span. Left to right are the 45-conductor, steel rope core cable for the intricate control system; the 6-conductor cable that powers the main drive motors; the 12-conductor, steel rope core cable that controls and powers the auxiliary drive motors. Each cable is protected against constant bending as well as environmental conditions by a tough, reinforced wall of mold-cured Okoprene.

where there's electrical power . . . there's **OKONITE CABLE**

5536

The trend to BIG

It is widely recognized that in recent years there has been a very definite trend to "BIG" units. In the early 'fifties, a number of orders were placed for units in the 200 mw range, and, by 1952, the maximum size had reached 250 mw. Since then, a substantial number of units for capacities from 250 mw up have been ordered.

The following paragraphs reveal the extent to which C-E Boilers have been chosen for this "250 mw and up" category and give some interesting highlights of these large units:

- Nineteen C-E Boilers have been ordered thus far to serve turbine-generators with capacities from 250 mw up. The largest—rated at 500 mw—is the biggest unit ordered to date. The aggregate capacity of these units is well over 5½-million kilowatts.
- All but two of the C-E Boilers in this size range are of the controlled circulation design, and these two are C-E Sulzer Monotube Boilers for supercritical pressures.
- All but one of the boilers incorporate the C-E Twin-Furnace design . . . service-proved as the "Best for Big Boilers."
- All the boilers are designed to supply steam at *throttle pressures* from 2,000 psig up. The two C-E Sulzer units are to operate at supercritical pressure . . . one at 5,000 psi.
- The size pattern of these boilers may have some significance. There are 6 of 325 mw capacity, 5 of 275 mw, 4 of 250 mw and one each of 260, 300, 340 and 500 mw. The average is over 300 mw.

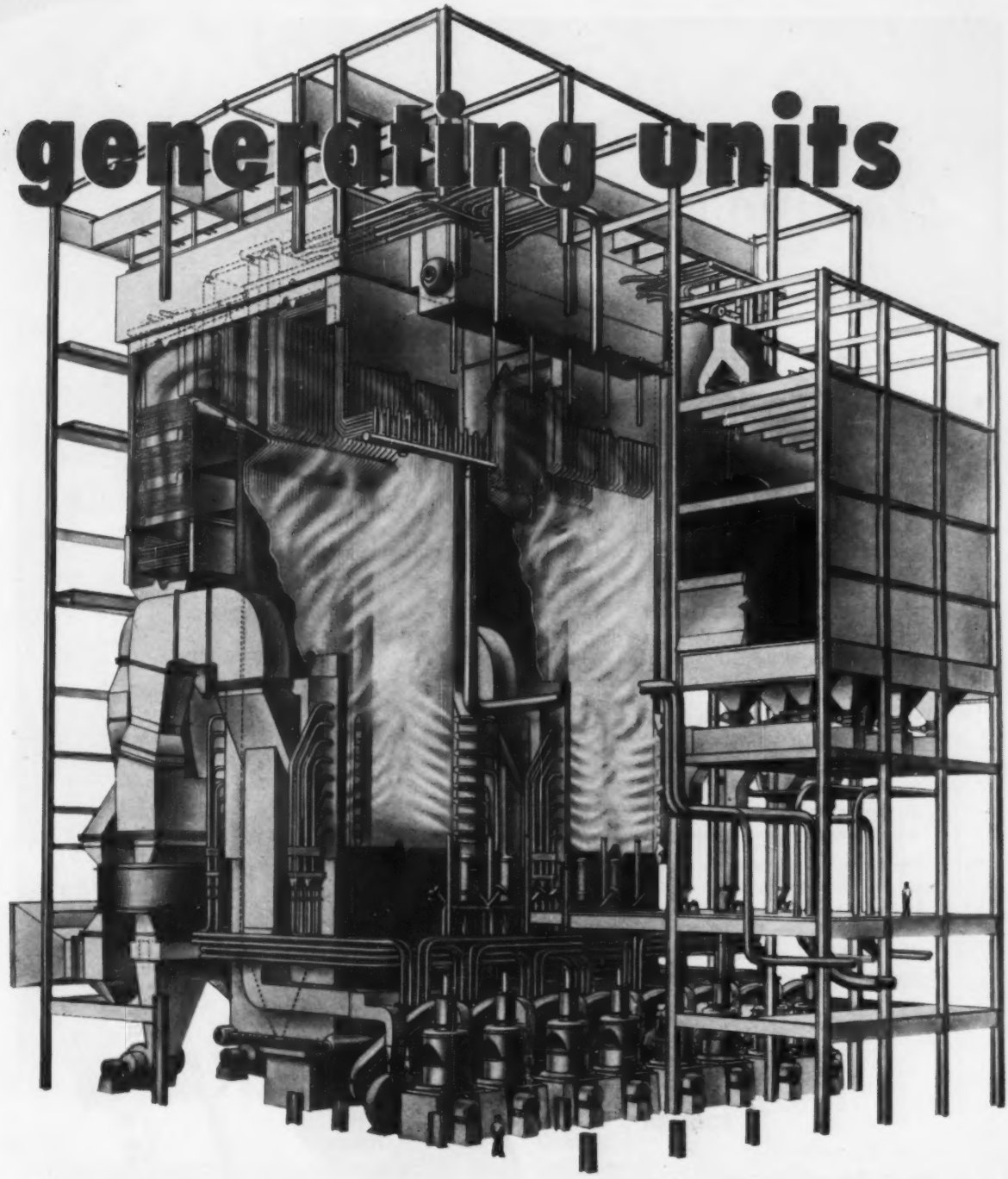
The extent to which C-E Boilers have been selected in this important size area evidences the widespread recognition of such design advantages as Controlled Circulation, Twin-Furnace arrangement and Tangential Firing. These features of C-E "Big" Boilers offer greater design flexibility, faster load response, steadier water level, shorter outages for maintenance and quicker start-ups, as well as tight control over superheat and reheat temperatures and minimum use of spray water for desuperheating. They add up to important plus values in today's "Big" Boiler field.

COMBUSTION

Combustion Engineering Building

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS;

generating units



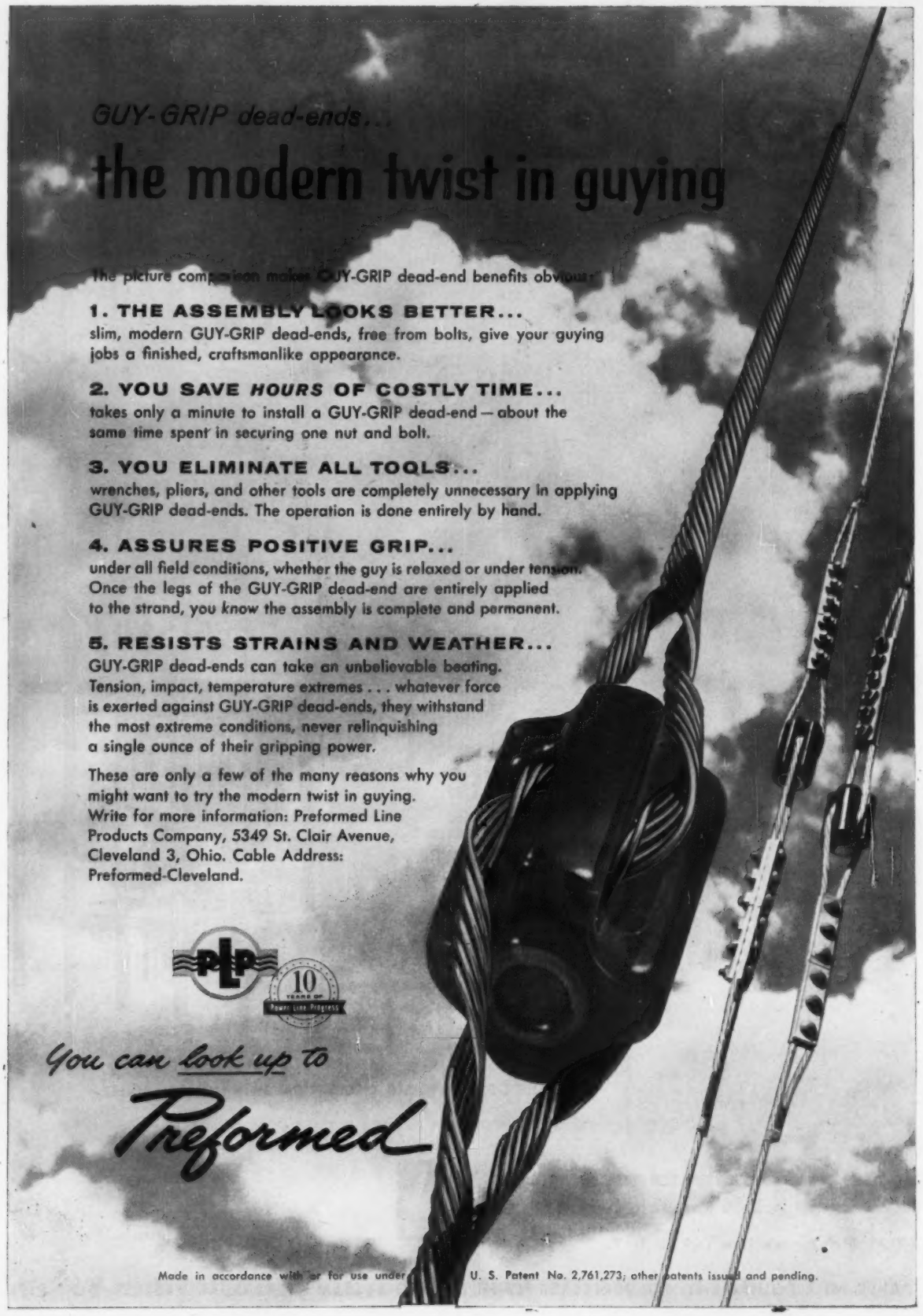
THE C-E CONTROLLED CIRCULATION TWIN-FURNACE BOILER

ENGINEERING

C-150

200 Madison Avenue, New York 16, N. Y.

PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE


GUY-GRIP dead-ends...
the modern twist in guying
The picture comparison makes GUY-GRIP dead-end benefits obvious!
1. THE ASSEMBLY LOOKS BETTER...
slim, modern GUY-GRIP dead-ends, free from bolts, give your guying jobs a finished, craftsmanlike appearance.
2. YOU SAVE HOURS OF COSTLY TIME...
takes only a minute to install a GUY-GRIP dead-end — about the same time spent in securing one nut and bolt.
3. YOU ELIMINATE ALL TOOLS...
wrenches, pliers, and other tools are completely unnecessary in applying GUY-GRIP dead-ends. The operation is done entirely by hand.
4. ASSURES POSITIVE GRIP...
under all field conditions, whether the guy is relaxed or under tension. Once the legs of the GUY-GRIP dead-end are entirely applied to the strand, you know the assembly is complete and permanent.
5. RESISTS STRAINS AND WEATHER...
GUY-GRIP dead-ends can take an unbelievable beating. Tension, impact, temperature extremes . . . whatever force is exerted against GUY-GRIP dead-ends, they withstand the most extreme conditions, never relinquishing a single ounce of their gripping power.
These are only a few of the many reasons why you might want to try the modern twist in guying. Write for more information: Preformed Line Products Company, 5349 St. Clair Avenue, Cleveland 3, Ohio. Cable Address: Preformed-Cleveland.
PLP
10 YEARS OF Power Line Progress
You can look up to
Preformed
Made in accordance with or for use under U. S. Patent No. 2,761,273; other patents issued and pending.

The Electrical Newsletter

FUTURE NEWS ▶ **What investor-owned utility will have the honor** of throwing the switch for industry's 100,000th Mw of generating capacity?

FPC will probably escape this session a probe by House Committee on Legislative Oversight, which has stirred up a ruckus in FCC.

LATE NEWS ▶ **"One fourth of U.S. installed capacity will be in nuclear plants"** in 1978, predicted Westinghouse's Tomlinson Fort at SEE annual meet. In other forecasts, AGE's Philip Sporn said "By 1975, around 5% of the then total capacity may well be atomic;" and EW's Fischer Black saw 4% of electrical energy coming from nuclear in 1975.

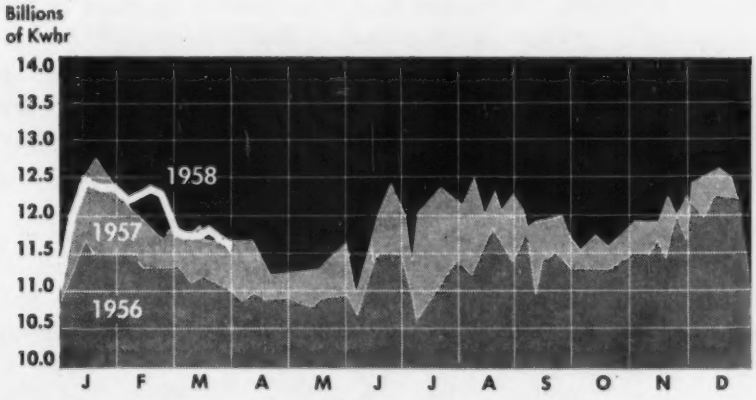
New SEE officers are: President, G. L. Furr, who is VP-Gen mgr, Appalachian Electric Power; First VP, F. H. Coughlin, president, Central Louisiana Electric, Second VP, W. C. MacInnes, president, Tampa Electric; Third VP, O. J. Miller, executive VP, Duke Power. Two new directors are Walter Bouldin, president of Alabama Power, and D. E. Stultz, president of Potomac Edison.

Co-ops would be justified in turning to the market for future funds because of their outstanding progress and high earnings margins, declares Texas P&L Pres W. W. Lynch at Southwest Electric Conference. He hailed recent REA ruling changes as first step in putting co-ops on mature basis . . . Interstate Power Pres M. L. Kapp is new chairman. Vice chairman: Houston Lighting Pres W. A. Parish.

Negotiations resumed March 25 to end OVEC-UWUA deadlock over contract terms at Kyger Creek but 39-day strike went on at EW presstime.

EEI elects three new members. They are Mystic Power, Northampton Electric Lighting, and Southern Berkshire Power & Electric.

Power Output–Down 0.4% (Week ending Mar. 29), Kwhr 11,645,000,000



Per Cent Change From Previous Year

	Mar. 15	Mar. 22	Mar. 29
Total U.S.	+1.8	+0.3	−0.4
New Eng.	+1.9	+3.8	+2.4
Mid. Atlantic..	+1.7	−0.3	+0.2
Cent. Ind.	−1.1	−2.5	−4.2
West Cent.	+2.5	+2.2	+1.3
Southeast	+3.3	+3.1	+2.6
South Cent. ...	+1.9	−0.7	+1.5
Rocky Mount...	+6.5	+0.8	−1.3
Pacific			
NW	+1.9	−0.6	−1.0
SW	+4.5	+0.5	−1.4

Seasonally Adjusted Index 227.0

Week Ago 228.1 Year Ago 227.5

Atomic Energy Commission requirements—1,050,000,000 Kwhr (Electrical World Estimate). Excluding AEC, output increase was 0.5%.

EVENTS ▶ **What's the power picture today in the ever-changing Northwest?** Despite the present calm atmosphere and adequacy of energy, power men in the area are worried. They see problems ahead: in meeting expected high loads in the 60's; in Oregon's revolutionary initiative bill; in a plan to replace BPA with a regional corporation; and, as always, in the fish-vs-dam problem. Controversy also looms over new proposal for a high Mountain Sheep dam. For a comprehensive look at progress, politics, and partnership in the area, see **p 66.**

The economic climate varies around the country. Reports from McGraw-Hill news bureaus tell of some regional bright spots in generally cloudy skies: construction is increasing in the Southwest, auto sales have picked up in Cleveland, and the economy in the Southeast appears relatively healthy. But steel and lumber men are still looking for an upturn **(p 63).**

WASHINGTON ▶ **Utilities chalk up a big victory** in the Senate's recent passage of a bill to restore 90-10 ratio on relocation costs. But there's still a chance that foes of the bill can block payments in courts **(p 62).**

SHOPPING CENTER DISTRIBUTION ▶ **How can distribution engineers best serve the shopping centers** now rising at a steady pace throughout the country's suburbs? How can they provide reliable and economical service and overcome problems inherent in this new, but important load? Four prominent distribution engineers present the results of their planning experience in the special Electrical World feature starting on **page 69**

In Chicago, Commonwealth Ed shows how it varied supply schemes to overcome certain problems it faced at large shopping centers. The utility, which used primary voltages of 4, 12, or 34.5 kv, illustrates its story with examples of design and construction plans **(p 70).**

In the Detroit area, three methods are used successfully by Detroit Ed in meeting shopping center needs: 1) Underground service, which is reserved for the very large centers; 2) Overhead circuits, with buildings specially designed to support transformers on roofs; and 3) Conventional overhead distribution with transformers on poles **(p 73).**

In Virginia, Vepco finds overhead distribution serves the needs of almost all installations. But where layout of the center makes this impractical, the utility turns to underground if the owner will agree to pay for the additional costs involved **(p 75).**

And in New York, LILCO solves both present and future needs of a large shopping center on Long Island, an area whose soaring population growth is expected to continue. The solution: a reliable and economical underground system with secondary network designed for second contingency operation **(p 77).**

GENERATION ▶ **Kyger Creek station finds it can save 832 man-hours annually** per boiler by using self-adjusting scrapers for slag-blower tubes. Another big saving was in cost of replacing seals **(p 86).**

DISTRIBUTION ▶ **Raising wires for house-moving is easy** when you use a double-arm pole fastened to a truck's A-frame. This scheme, adapted by Montana-Dakota Utilities, saves time and avoids de-energizing of lines and setting temporary poles **(p 82).**

MANAGEMENT ▶ **How much does nuclear power cost?** Nobody knows, exactly. Speakers at the Atomic Energy Management Conference, held recently in Chicago, pointed out that today's cost estimates rest on many assumptions that only time and experience can test for accuracy. But nuclear costs will turn down, said the speakers. Plants will be redesigned and simplified for economy, and the Canadians are shooting for one-mill-per-kwhr fuel **(p 123).**

INDUSTRIAL ▶ **A Baltimore firm emerged from the dark ages** when it replaced its 5-foot-candle system with up-to-date reflector lamps. Advantages: better safety conditions, fewer production errors, reduced maintenance . . . Operation costs were sliced by 75% after a Pennsylvania metal floor and wall fabricator began using electrically heated cleaning baths to remove accumulated paint from dip tank hooks **(p 134).**

SELLING ▶ **How can you estimate the bill of a temporarily unmetered customer?** More and more utilities are asking this question as they get deeper into the residential space heating field. One successful solution is described by Seattle City Light's E. G. Poole on **p 131.**

MANUFACTURERS ▶ **Sangamo's production lines are busy turning out Secovar capacitors** at top speed. Since recent development of these secondary units, production line volume has had to be accelerated to meet demand by electric utilities **(p 95)** . . . Latest product of Copperweld Steel research is Alumoweld, an aluminum-covered steel rod which can be redrawn into wire **(p 96)** . . . GE is planning a $3.7-million steel casting foundry which will boost its foundry production by 50% **(p 95).**

NEW EQUIPMENT ▶ **New insulator for contaminated atmosphere** uses concept of trapped air space within the insulator bowl to reduce exposed insulator area and contamination . . . You can test watthour meters for full load, 50% power factor, and light load in about 54 seconds with a new calibrator. Each test takes only one revolution **(p 104).**

PEOPLE ▶ **In series of top executive changes,** William J. Cooper is elected president of United Illuminating to succeed William C. Bell, who becomes chairman of the board. Laurence A. Dunn rises to assistant VP and retains post of merchandise manager . . . R. H. Williams moves up to VP-public relations at Public Service E&G **(p 136).**

How should a company be managed in our rapidly changing economy? Of course there is no set answer to this question. But a recently published book entitled, **"Management in a Rapidly Changing Economy"**, will tell you what some of our country's top-level executives think about this. The book is based on material presented at Harvard Business School's 27th National Business Conference. Successful management has always been associated with the ability to cope with change and to resist any urge to specialize at the sacrifice of the broad outlook. A reading of this book's table of contents will show that the editor of it had this approach in mind. All the many economic, technical, marketing and social changes that are predicted for the next decade are discussed. Of particular interest to the utility executive (and the aspiring executive, too) should be material on investments, and technological, income, and population changes.— **Management in a Rapidly Changing Economy. Edited by Dan H. Fenn, Jr. Published by McGraw-Hill Book Co, Inc, 330 W 42nd St, New York 36, N. Y. 339 pages. Price $5.00**

TECHNICAL NOTES

Electronic reading machine, powered by flashlight batteries, reads handwritten numbers and letters as they are written. The device, about the size of a portable typewriter, was developed by Bell Telephone Laboratories.

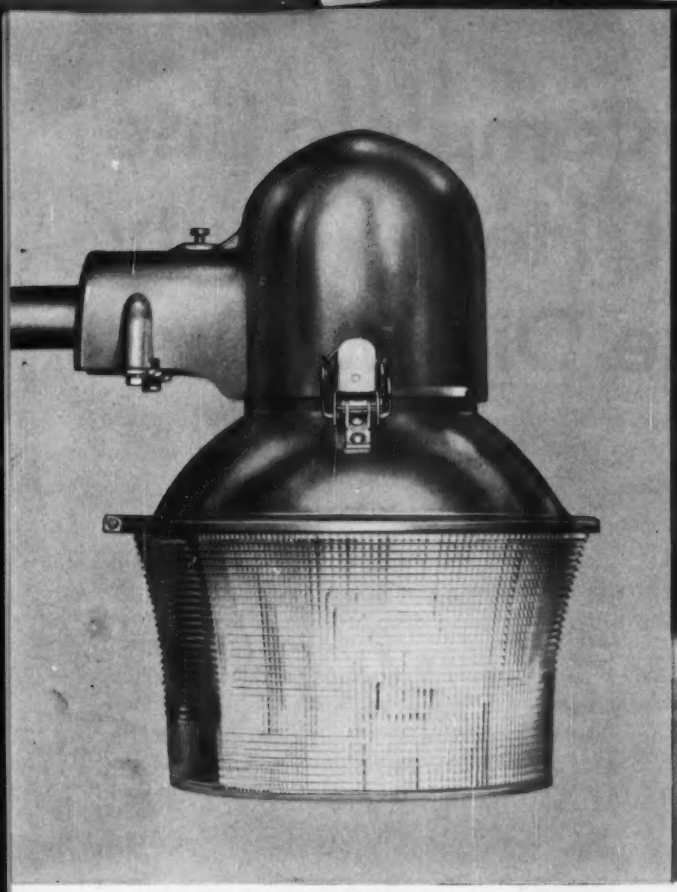
Probability of loss of load decreases very rapidly with small increases in interconnection capacity. The problem of selecting a reasonable probability of loss of load is therefore a relatively minor one.

There is a difference between fusion and thermonuclear reactions. If two ions collide and fuse we call this a fusion reaction. If two ions in a uniformly hot gas collide and fuse we call this a thermonuclear reaction.

Heating and pressurizing coal under radiation is a new method for converting coal into synthetic natural gas. Radioactive cobalt helps to convert the coal by catalyzing the break-down process which occurs when hydrogen gas is introduced.

FROM EDITORS IN THE FIELD

Three-wheeled scooter with enclosed cab is on trial in Frederick, Md., to help Potomac Edison Co beat traffic congestion. The scooter is used for city collections, meter reading on the city's outskirts, and in-city deliveries.



L-M'S OPEN TYPE SUBURBANAIRE unit provides highly efficient lighting, with choice of mercury vapor or incandescent lamps, scientifically designed optical system, and low original cost and simple maintenance. Also available with photoelectric control.

ONE OF THE L-M SUBURBANAIRES that light the 24 blocks of Mulholland's beautiful new Oakdale Subdivision, Oak Lawn, Ill. Multiple service is all underground. Knott & Mielly, Chicago, were the electrical contractors in this highly attractive, efficient installation that helps makes the homes in this subdivision more salable.

Subdivider Chooses L-M Suburbanaire To Light New Oak Lawn, Ill., Development

To provide modern, efficient lighting with economical maintenance, Clem B. Mulholland, Inc., selected the L-M Suburbanaire unit to light its new Oakdale subdivision in Oak Lawn, Ill. Knott & Mielly, Chicago electrical contractors, made the installation.

Helps Sell Homes

The L-M units were selected, and the lighting system was planned, to provide safety and added nighttime beauty. The street lighting was a strong selling feature. That this is effective is indicated by the fact that in a neighboring subdivision that is similar but not lighted, homes do not sell nearly so well as in Mulholland's well-lighted Oakdale subdivision.

Luminaires are mounted on 8-foot upsweep brackets on 25-foot metal poles. Service is multiple, on six photoelectrically controlled circuits. All wiring is underground. Normal spacing of the lights is 300 feet, which provides a luminaire at each corner and in the center of the block.

The whole lighting program has been most gratifying to the subdivider, and the residents who have purchased Oakdale homes, and to Village Manager Camille Andre and other officials of the Village of Oak Lawn, who heartily approve the choice of lighting.

Get Complete Information

Many subdividers have had similar experiences with the use of lighting as a selling feature. L-M offers a full line of luminaires of all types—incandescent, mercury vapor, and fluorescent—for rural, neighborhood, shopping center and highway lighting, together with application engineering service. Call the nearest L-M office for a lighting engineer; or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada, Canadian Line Materials, Toronto 13, Ontario.

McGRAW EDISON

334

LINE MATERIAL Industries Outdoor Lighting

McGRAW-EDISON COMPANY

Only L-M Offers Complete Line of Low-Cost, Heavy-Duty Three-Phase Oil Switches

Now all types of loads—capacitive or inductive—can be switched economically with manual or remote operation, using one of the Kyle "V" family of three-phase oil switches.

Three Types of Switches

L-M's Kyle "V" family consists of three basic types of switches:

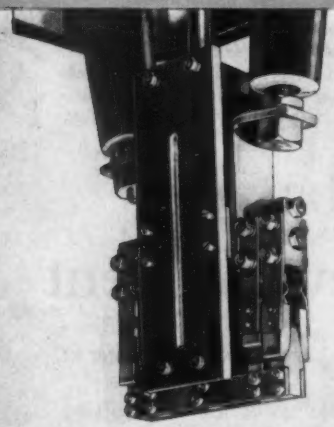
1. One for general-purpose switching, such as single-step capacitor switching and automatic transfer of normal power-factor loads.

2. One for automatic transfer and tie schemes involving loads having low lagging power-factor currents, such as unloaded motors.

3. One designed specifically to withstand the severe duty imposed by step-switching capacitors.

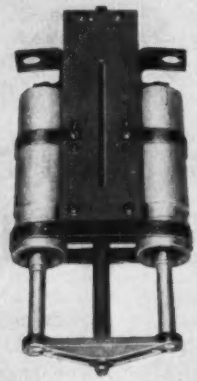
These switches have a maximum design voltage of 15.5 kv, a momentary rating and latching rating of 20,000 amperes (asymmetric), and a four-second rating of 6,000 amperes (symmetric).

All three switches are available with motor-driven actuator assembly for remote electrical operation. The general-duty (1) and inductive-current (2) switches are also available for hook stick operation, or with remote manual linkage for operation from base of pole.



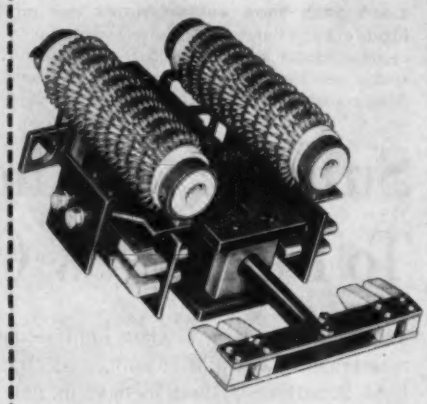
GENERAL DUTY CONTACT ASSEMBLY

Copper-tungsten arcing contacts absorb the punishment of switching, keeping erosion on load contacts at a minimum.



INDUCTIVE CURRENT CONTACT ASSEMBLY

Interrupting tubes assure minimum arcing time during load-current interruption, thus enabling the switch to handle currents with power factor as low as 10% lagging.



STEP CAPACITOR CONTACT ASSEMBLY

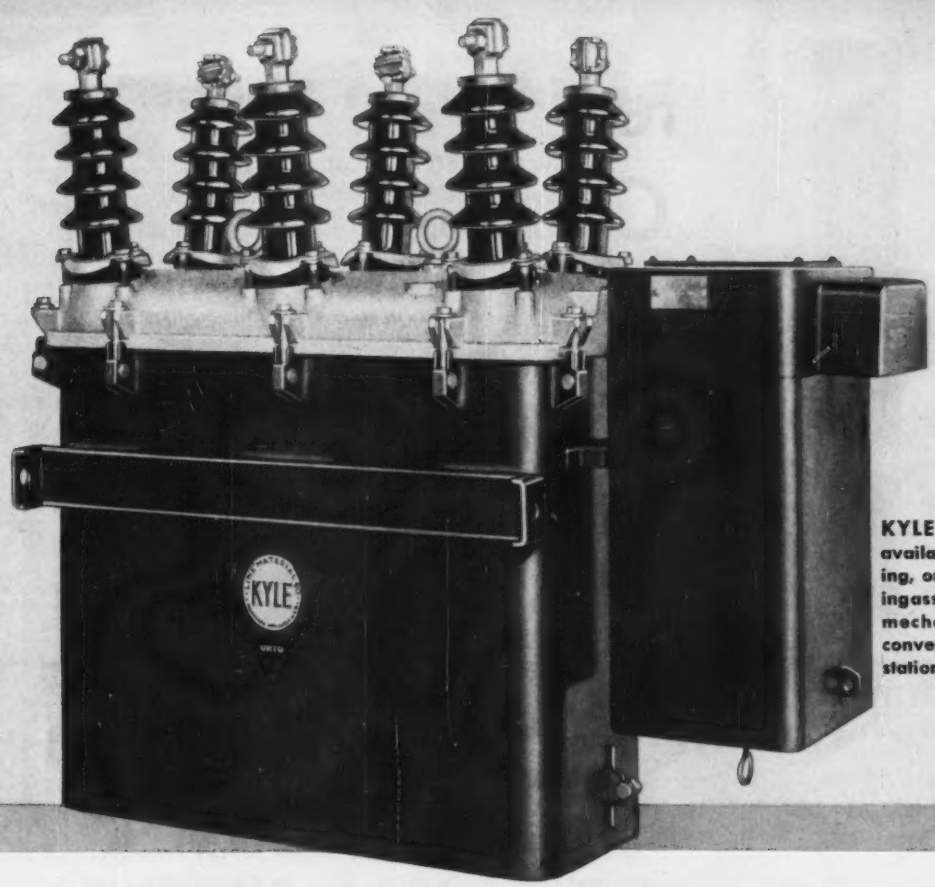
7½ ohms of resistance in series with arcing contacts limits the high-frequency transient inrush to values within the short-time capability of the switch.

Get More Complete Information

L-M offers the most complete line of oil switches and accessories for manual and automatic load transfer and switching schemes. Ask your L-M Field Engineer for information and bulletins. Or write Line Material Industries, Milwaukee 1, Wisconsin.

LINE MATERIAL Industries

McGRAW-EDISON COMPANY



KYLE "V" SWITCHES are available for crossarm mounting, or with substation mounting assembly, including hoisting mechanism, to provide for convenient and versatile substation installation.

KYLE® Heavy-Duty, Three-Phase Oil Switches 400 Amp. 110 kv BIL

2.4 kv through 14.4 kv • Maximum design voltage 15.5 kv • Momentary rating 20,000 amps (asymmetric) • Four-second rating 6,000 amps (symmetric)

	SWITCHING RATINGS	TYPES	PRICE	APPLICATIONS
General Duty Switch	**7.2 kv through 14.4 kv** 75-100% p.f. 200 amps rms 40-75 % p.f. 100 amps rms 10-50 % p.f. 50 amps rms **2.4 kv through 7.2 kv** 75-100% p.f. 400 amps rms 50-75 % p.f. 200 amps rms 10-50 % p.f. 100 amps rms	**Hook Stick Operation** **Remote Electrical Operation** **Remote Manual Operation**	VH $625 VR $885 VM $710	Manual sectionalizing switches. Automatic transfer schemes for duplicate service, feeder switching, bus transfer switching, bus ties. Single-step capacitor switching.
Inductive Current Switch	Switches are capable of switching their full continuous rating, 400 amps from unity power-factor down to 10% lagging power-factor.	**Hook Stick Operation** **Remote Electrical Operation** **Remote Manual Operation**	VLH $655 VLR $915 VLM $740	Automatic transfer and tie schemes involving low lagging power-factor currents.
Step Capacitor Switch	Nominal capacitor switching current 300 amperes	**Remote Electrical Operation**	VCR $1055	Designed specifically to withstand the severe duty imposed by multi-step switching of capacitor banks.

The Kyle Type VR, VLR and VCR switches are equipped with motor-operated actuator mechanisms to make possible remote electrical operation. Such remote operation can be initiated either by push button or through current, voltage, time-sensitive, or other relay scheme.

ACCESSORIES

Available on VR, VLR, and VCR.

A 1, 2, 3, or 4-stage auxiliary switch can be factory installed for use when the VR switch is used with relay or interlocking schemes or switchboard position indication.

Low-voltage arresters can be installed within the actuator housing.

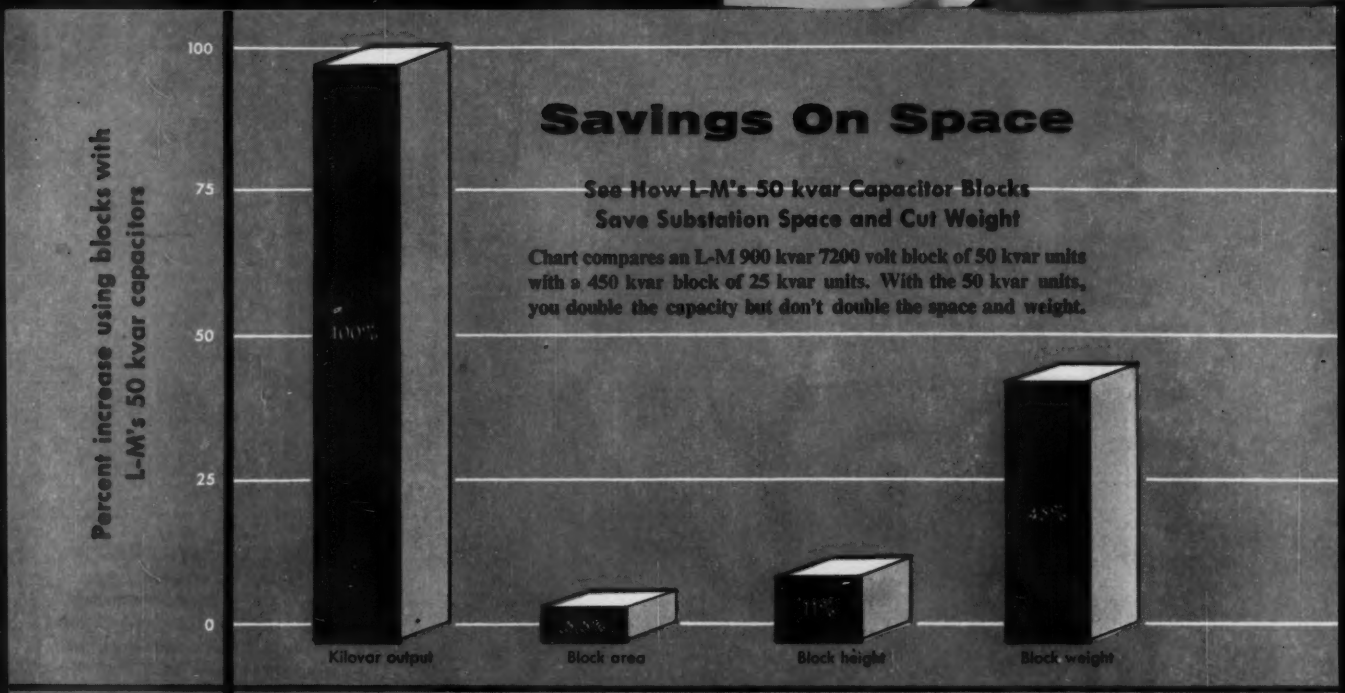
Heating element can be installed in the actuator housing when application is in unusually damp, foggy, or humid atmospheres.

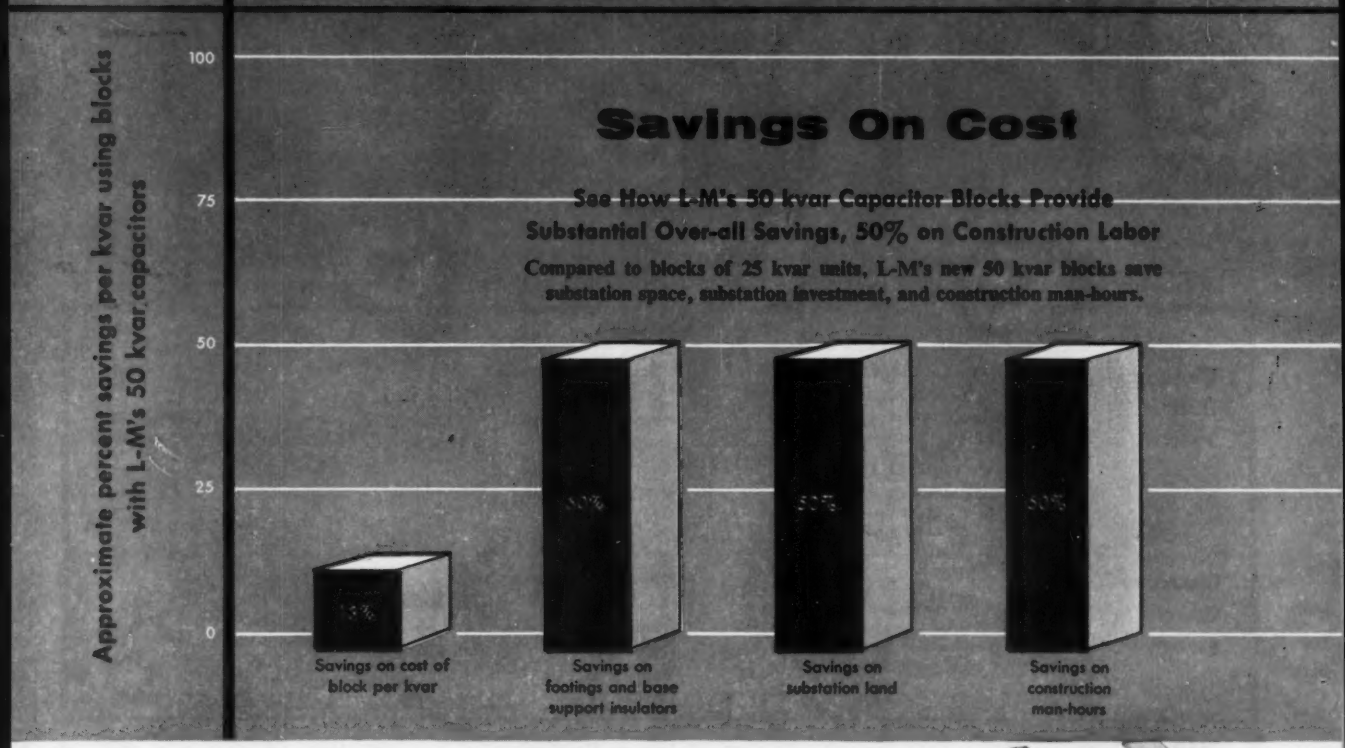
15" and 17" creepage distance bushings are available for the entire family of switches.

Kyle® Oil Switches

333

McGRAW EDISON


Percent increase using blocks with L-M's 50 kvar capacitors
100
75
50
25
0
Savings On Space
See How L-M's 50 kvar Capacitor Blocks Save Substation Space and Cut Weight
Chart compares an L-M 900 kvar 7200 volt block of 50 kvar units with a 450 kvar block of 25 kvar units. With the 50 kvar units, you double the capacity but don't double the space and weight.
100%
Kilovar output
Block area
Block height
Block weight


Approximate percent savings per kvar using blocks with L-M's 50 kvar capacitors
100
75
50
25
0
Savings On Cost
See How L-M's 50 kvar Capacitor Blocks Provide Substantial Over-all Savings, 50% on Construction Labor
Compared to blocks of 25 kvar units, L-M's new 50 kvar blocks save substation space, substation investment, and construction man-hours.
Savings on cost of block per kvar
Savings on footings and base support insulators
Savings on substation land
Savings on construction man-hours

ANOTHER L-M CAPACITOR FIRST . . .

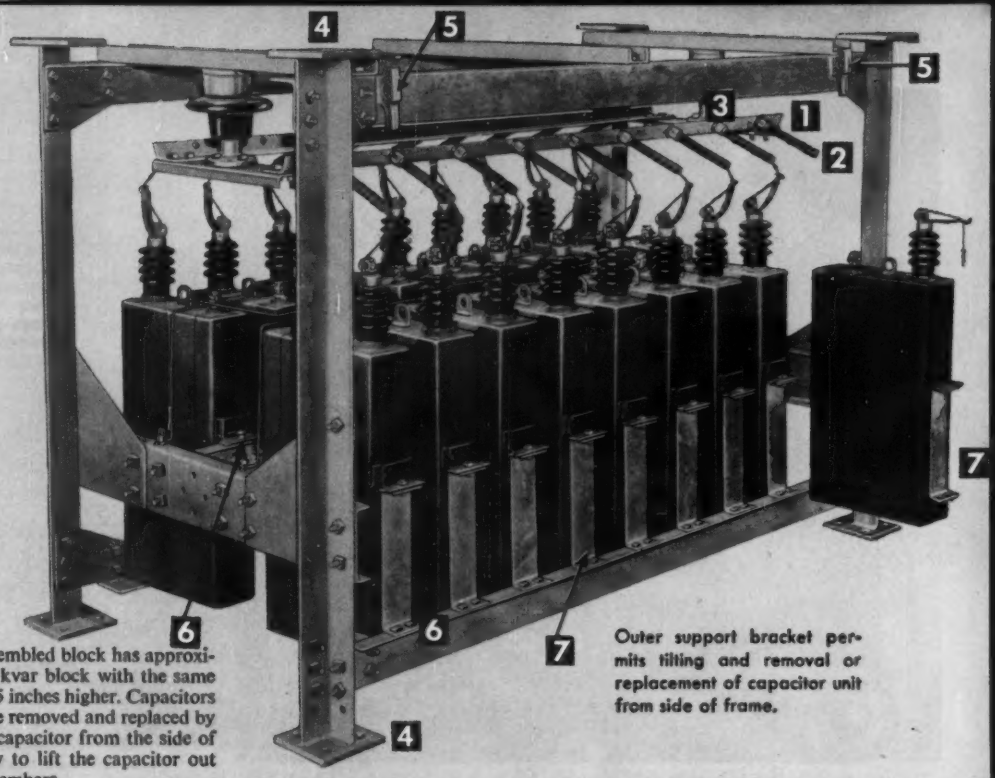
Units Now Shipped in New "Tear Strip" Carton

All individual L-M capacitor units are now packed in cartons that can be quickly and easily removed.

The new carton has a reinforced cloth tape cemented around the inside about two inches above the bottom. The tape is attached to pull tabs on the outside of the carton. When the tab is pulled, the tape makes a cut completely around the carton. The carton can then be quickly and easily lifted off the capacitor.

Simply pull the tape—to remove the carton.

296-B


1 Aluminum-alloy bus
2 Bus-mounted fuses
3 Bus connections wire brushed and treated with oxidation inhibitor.
4 Jig-assembled for perfect alignment of mounting pad bolt holes.
5 Lifting lugs.
6 Tapped holes in frame for capacitor mounting bolts. Nuts not needed.
7 Outer support bracket permits tilting and removal or replacement of capacitor unit from side of frame.

L-M's new 50 kvar factory-assembled block has approximately the same area as a 25 kvar block with the same number of units and it is only 5 inches higher. Capacitors in L-M's 50 kvar blocks can be removed and replaced by simply tilting and sliding the capacitor from the side of the block. It is not necessary to lift the capacitor out from between the mounting members.

Another L-M First...

L-M's 50 Kvar Capacitor Blocks Provide Kilovars At Still Lower Costs

By **BLAINE SCHULTZ**
Chief Engineer
Capacitors and Regulators
Line Material Industries

Only half as many units are required in substation capacitor banks when you use L-M's new blocks of 50 kvar capacitors. In addition, these blocks reduce the number of fuses, footings, and base support insulators, as well as the construction man-hours required for any given-size bank. L-M 50 kvar preassembled capacitor blocks also cost less and require about 50% of the substation area per kvar in comparison with blocks containing 25 kvar capacitors.

Capacitor Unit

The internal construction of L-M's 50 kvar capacitor is identical with that of the 25 kvar unit except for the length of pack. There is no increase in voltage stress to get the higher kvar rating. The new design is the result of continued improvement in dielectric materials and manufacturing techniques.

The tank has the same width, same thickness as the 25 kvar capacitor. Only 10 inches of additional height give you twice the capacity. It also has aluminum-metallized coating under alkyd resin paint; paragroove clamp-type terminals; strong solder-sealed bushings; and low-temperature Elemex liquid dielectric.

Factory-Assembled Blocks

L-M offers a complete line of NEMA Standard 50 kvar factory-assembled blocks from 2400 through 7960 volts—400 to 1200 kvar ratings in 100 kvar increments.

Outstanding features of L-M factory-assembled blocks include:

- Aluminum-alloy bus which is not subject to cold flow.
- Bus-mounted capacitor fuses with stainless-steel flipper to eject the leader if fuse link ever blows. Leader cannot hit live parts.
- Connections to the bus are wire brushed, and treated with oxidation inhibitor.
- Height of block is increased only 5 inches, because it is so designed that capacitors can be installed and removed from the *side*. It is not necessary to provide clearance to lift the capacitor out from between the mounting members.
- Heavy galvanized frame is jig-assembled for perfect alignment of mounting-pad bolt holes.

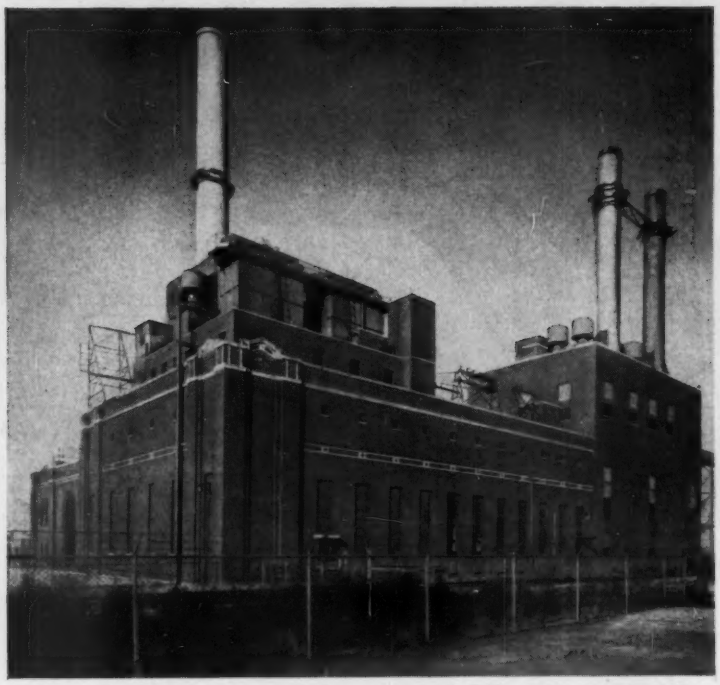
Prompt Delivery Now

You can save on the cost of equipment, man-hours, and space in the substation when you specify L-M NEMA Standard 50 kvar capacitor equipments. Prompt delivery . . . on all sizes and voltage ratings. Ask your L-M Field Engineer for complete information on L-M's new 50 kvar factory-assembled capacitor equipments. Or write Line Material Industries, Milwaukee 1, Wisconsin.

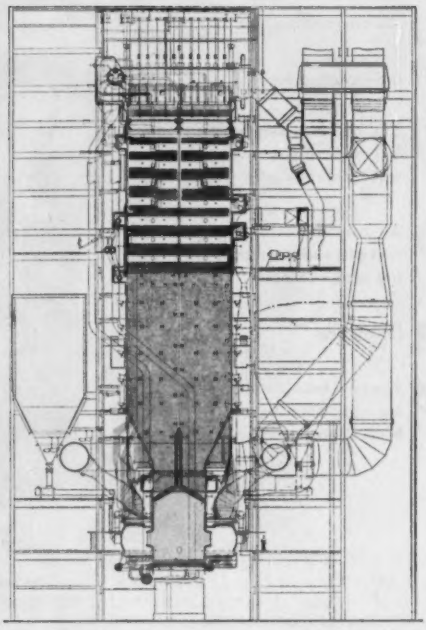
McGRAW EDISON

296-AR2

LINE MATERIAL Industries *Elemex Capacitors*
McGRAW-EDISON COMPANY



On the line for eight years at Commonwealth Edison Company's Joliet Station, 2 B&W Cyclone Furnace Boilers produce 1,200,000 pounds of steam per hour.



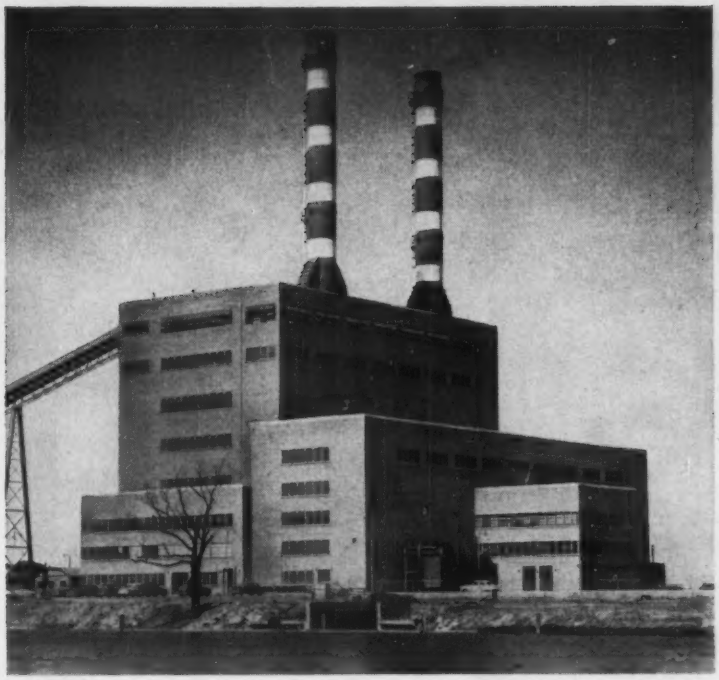
New Cyclone Furnace unit under construction for Joliet Station will generate 2,200,000 pounds of steam per hour. It will burn highly volatile Central Illinois coal with a high ash content and low ash-fusion temperature.

Proof in Action Means Continued Acceptance for B&W Cyclone Furnaces

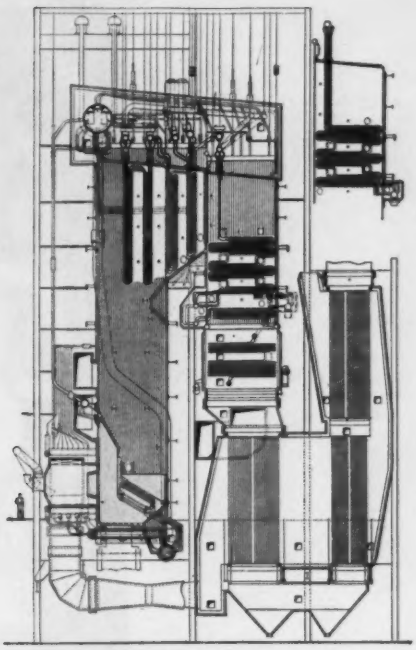
ON-LINE UNITS PROVIDE MODERN MEANS OF BURNING FUEL ECONOMICALLY

In installation after installation, the efficiency, economy and simple operation of B&W Cyclone Furnaces have led to continued acceptance. At the Commonwealth Edison Company, where the first Cyclone Furnace was installed in 1944, 14 additional units are in operation with still another on order. And at Wisconsin Power and Light Company's Edgewater Station, a Cyclone-Fired Boiler achieved such an outstanding record that B&W Cyclone Furnaces were also specified for that Company's Rock River and Nelson Dewey Stations.

The B&W Cyclone Furnace simplifies the entire process of coal preparation, combustion, ash handling and ash segregaton. Its cost-saving quality contributes to lower fuel costs and re-



Rock River Station of Wisconsin Power and Light Company. Six B&W Cyclone Furnaces fire 2 B&W Boilers to produce 1,050,000 pounds of steam per hour.



New unit for Wisconsin Power and Light's Nelson Dewey Station will use a B&W Cyclone Furnace to fire boiler producing 700,000 pounds of steam per hour.

duced maintenance as well as increased operational simplicity, flexibility and safety. Recognition of these facts is attested by the 77 Cyclone Furnace Boilers now either in service or under construction throughout the country.

Many other modern advances in combustion and high-pressure, high-temperature steam generation are also available through B&W. They merit examination in connection with your next installation. Write for further information to The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

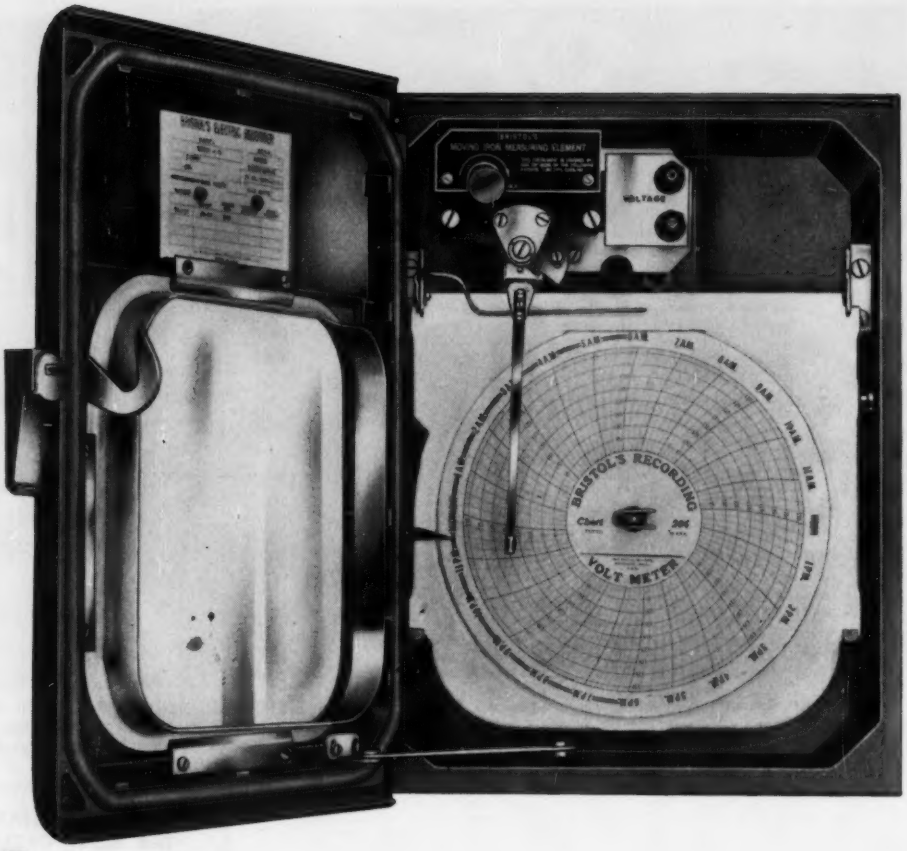
PURCHASERS OF THE B&W CYCLONE FURNACE

FOR CENTRAL POWER STATIONS	Number of Cyclone Furnace Boilers
Atlantic City Electric Co.	1
Baltimore Gas & Electric Co.	1
Chilena de Electricidad	2
Columbus & Southern Ohio Electric Co.	2
Commonwealth Edison Co.	16
Consumers Public Power District (Nebraska)	1
Detroit Edison Co.	1
Indiana & Michigan Electric Co.	1
Jersey Central Power & Light Co.	3
Memphis Light, Gas & Water Division	3
Middle South Utilities, Inc.	1
Missouri Public Service Company	2
Monongahela Power Co.	1
Northern Indiana Public Service Co.	3
Ohio Edison Co.	2
Ohio Power Co.	6
Public Service Co., of New Hampshire	1
Tampa Electric Co.	3
United Illuminating Co.	2
Wisconsin Power & Light Co.	4
FOR INDUSTRIAL INSTALLATIONS	
American Cyanamid Co.	1
American Enka Corp.	1
Clinton Corn Processing Co., Division of Standard Brands	1
Columbia Southern Chemical Co.	1
Consolidated Water Power & Paper Co.	1
Dow Chemical Co.	5
Eastman Kodak Co.	1
Greenwood Mills	1
International Paper Co.	4
National Container Corp., of Wisconsin	1
Rhinelander Paper Co.	1
St. Croix Paper Co.	1
Thilmany Pulp & Paper Co.	1
West Virginia Pulp & Paper Co.	1
Total	**77**

BABCOCK & WILCOX

BOILER DIVISION

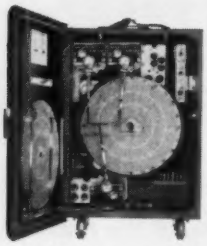
G-887



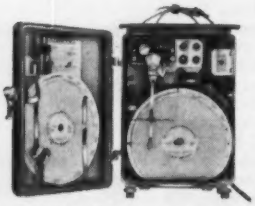
BRISTOL single-pen recording voltmeter for permanent surface or flush-panel mounting. Available for conduit or open terminal connections. Also made in portable and pole-mounting models.

NOW!

Series 500 voltmeters in 1-, 2-, and 3-pen models



New Bristol 3-pen recording voltmeter, portable model, features proved reliable moving-iron measuring elements. Ideal for checking balance in 3-phase systems.



BRISTOL MODEL 641 voltmeter or ammeter. This extra-compact folded-chart portable instrument is a favorite with utility men. 1- or 2-pen types only.

Bristol's recording voltmeters can now have as many as three independent moving-iron elements. Similar ammeters available

Rugged, precise (±1%) Bristol recording voltmeters are now available to record up to three independent voltages on a single chart.

The new 3-pen voltmeter uses the same durable, precise moving-iron elements tried and proved in Bristol single-pen and two-pen voltmeters. And like these field-proved Bristol instruments, the new 3-pen voltmeter comes in types for portable, portable and pole mounting, or wall, switchboard or flush-panel mounting. Single or double range. Check these outstanding features.

High Accuracy — ±1% of full scale.

High-torque moving-iron mechanisms — produce greatest torque possible, keep weight and power drain to minimum, assure positive recording over full range.

Low electrical burden — 5.5VA at 120V or 12VA at 240V for each mechanism.

High stability of calibration — seldom requires calibration.

Easy calibration in field — no special tools or skills required.

Rugged construction — shockproof bearings, pen locking device for shipping or carrying portable models.

Leveling not critical

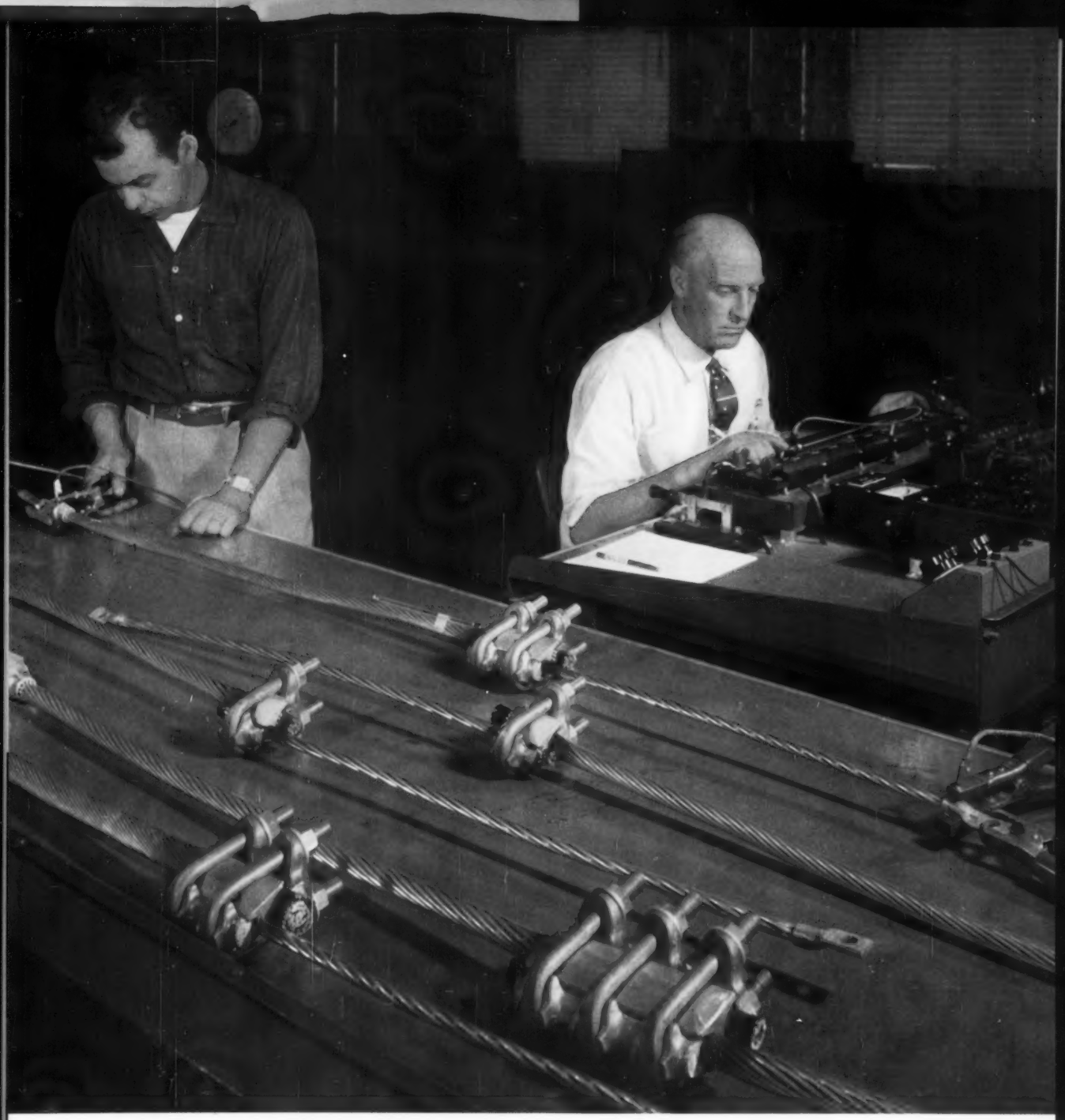
ASA models available — to specification C39.2–1953.

Write for complete data on Bristol 1-, 2-, or 3-pen recording voltmeters. The Bristol Company, 116 Bristol Road, Waterbury 20, Conn.

8.10

BRISTOL TRAIL-BLAZERS IN PROCESS AUTOMATION

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS



The electrical resistance of Alcoa connectors is carefully measured before heat cycle tests in one of the many development operations at Alcoa's Massena, New York, facilities.

ALCOA
RESEARCH
. . development today for tomorrow's loads

HOW ALCOA DEVELOPS MODERN CONDUCTOR ACCESSORIES

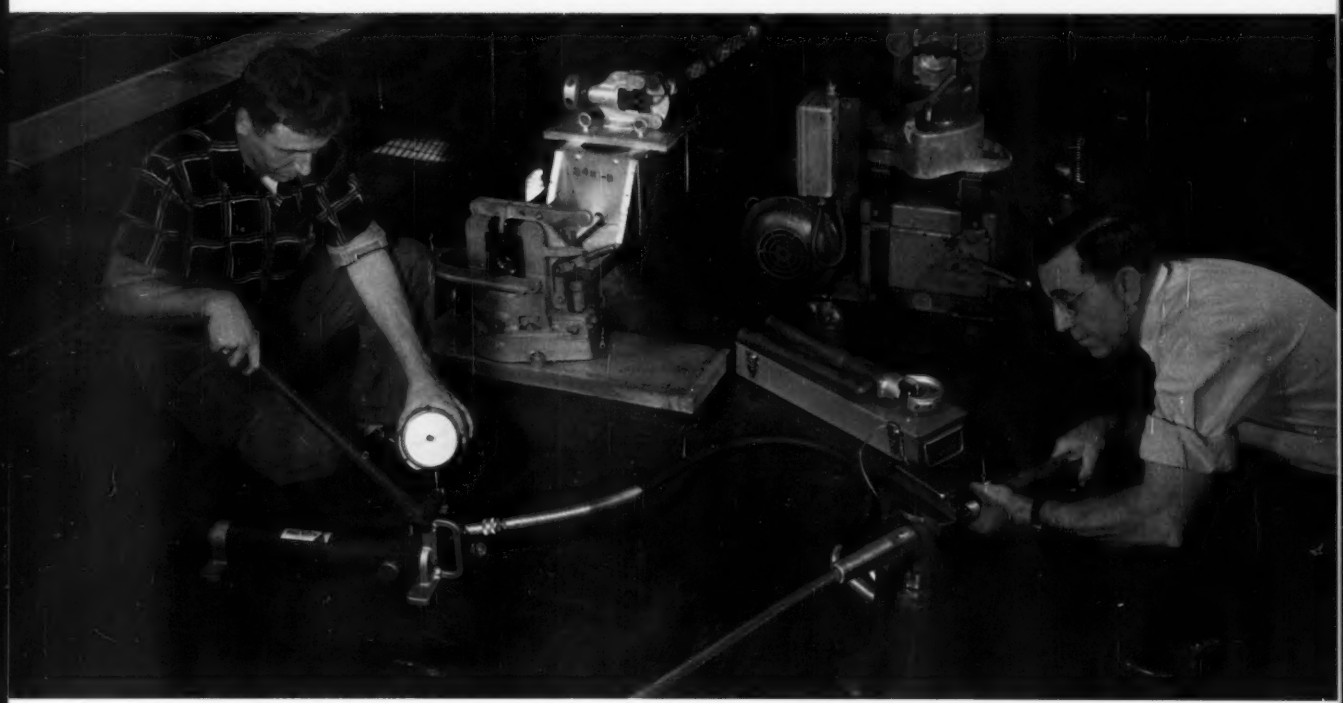
ALCOA RESEARCH

DEVELOPS EFFICIENT UNIVERSAL CONDUCTOR ACCESSORIES WITH TRADITIONAL DEPENDABILITY

With the sale of the first reel of conductor over 60 years ago, Alcoa immediately began work in another important field: accessories and tools.

As a result, Alcoa pioneered a complete line of connectors and clamps, dead-ends, joints, compressors, come-alongs and other tools. Constant research into the problems of conductor vibration led to the development of armor rods and Stockbridge dampers. Installation and maintenance of aluminum conductors have become easier and less costly through the years, and research for new and better accessories continues.

Typical of Alcoa's constant effort toward this end is the 580 series parallel groove clamp. For years, Alcoa's U-bolt clamp had given dependable service. But Alcoa engineers were seeking a clamp with a universal groove that would reduce the large number of different sizes required, without sacrifice of electrical efficiency.



Measuring the thrust required to close dies in development test on new Alcoa tubular accessories and compressor dies.

To find such a groove, a wide variety of geometric shapes were studied in special test plates. Each groove was evaluated against the known high performance standards of grooves made to fit each conductor. Low initial resistance and stable operation were demanded as characteristics of the shape Alcoa adopted.

Incorporating the new groove into practical designs led to testing of large numbers of prototype connectors. Special mechanical tests checked stresses. Other laboratory and field tests were used to evaluate the design. Clamps underwent 1,000 heat cycles with currents producing conductor temperatures as high as 200°F.

The result of all this testing and checking was the deep groove and pusher shape of the new Alcoa 580 series clamp, which has brought convenience to utilities. With this data and test background, plus immediate market acceptance, Alcoa has extended this design to the extruded "no loose parts" clamps, as well as terminals and tee connectors.

ALCOA ALUMINUM
ELECTRICAL CONDUCTORS AND ACCESSORIES
ALUMINUM COMPANY OF AMERICA

ALCOA RESEARCH

. . . development today for tomorrow's loads

Sand mold for aluminum castings of new 580 series universal groove clamp.

An order for new 580 series clamps is filled from Alcoa's accessory warehouse at Massena.

ALCOA RESEARCH

ASSURES FURTHER PROGRESS IN CONDUCTOR ACCESSORIES

As the electrical industry has grown, Alcoa research facilities have grown right along with it. By 1948, this phase of Alcoa's activities had expanded to such an extent that a special division was set up, known as the Electrical Engineering Division of Alcoa Research Laboratories.

At these laboratories in Massena, work is carried out on all problems involving the use of aluminum in electrical conductors and accessories. Tests are made under conditions as similar as possible to those encountered in the field. Expanded ACSR, aluminized steel core wire, welded aluminum bus fittings, basic vibration data, sleet melting techniques, armor rods and Stockbridge dampers are only a few of the many important results. With these facilities, Alcoa continues its efforts to supply the electrical industry with the most modern and efficient conductors and accessories at the lowest possible cost.

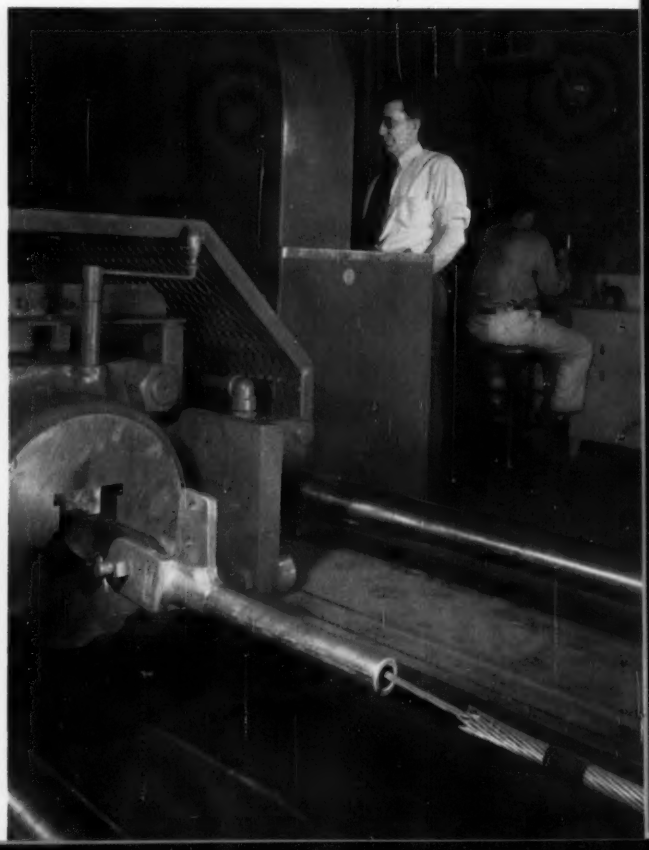
Below left: Testing the holding power of 220 series distribution dead-end clamp in Alcoa's physical testing laboratory.

Below right: Testing the holding efficiency of a compression dead-end consisting of steel clevis and aluminum body . . . this accessory must hold at least 95% of the rated strength of the conductor. Note that the steel core has not yet failed.

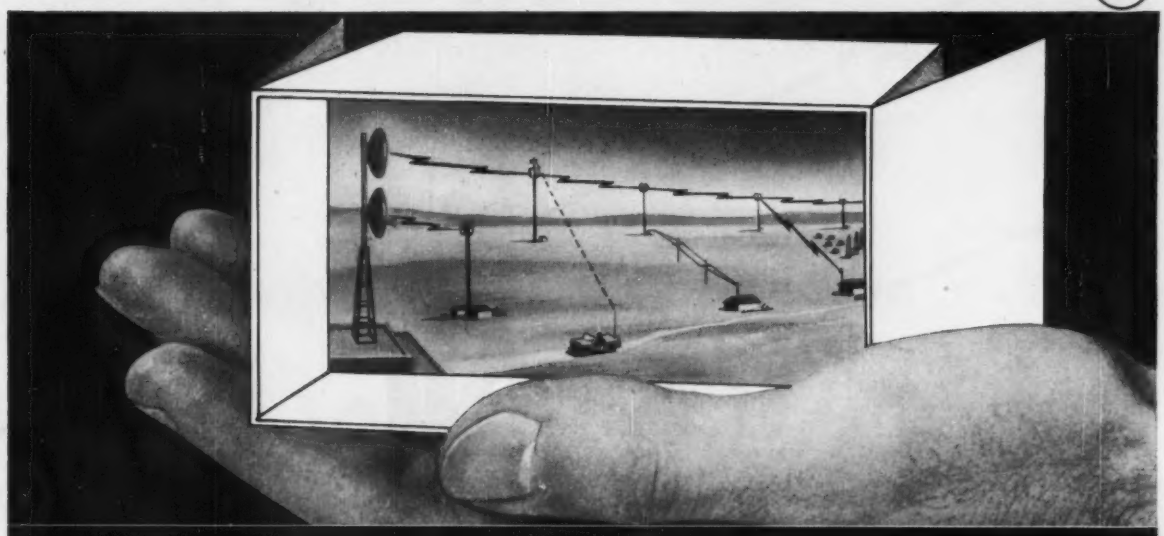
Your Guide to the Best in Aluminum Value

ALCOA ALUMINUM
ELECTRICAL CONDUCTORS AND ACCESSORIES
ALUMINUM COMPANY OF AMERICA

"ALCOA THEATRE"
Exciting Adventure
Alternate Monday Evenings



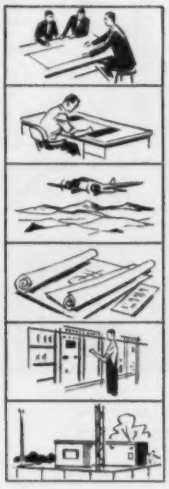
OVER A MILLION CHANNEL MILES OF RCA MICROWAVE NOW IN SERVICE... RCA



New RCA Microwave Package Delivers Complete Communications System from a Single Contract

One contract—single source of equipment—undivided responsibility

By turning over the entire responsibility for a communications project to RCA you can cut corners and relieve your own personnel of all details in connection with an installation. You can arrange for operating supervision and test operation before you take over. *Complete systems engineering is provided where desired.*



1. Planning entire project to provide necessary services by means of microwave radio communications.
2. Specification writing.
3. Aerial survey of terrain.
4. Submitting proposal covering designed system.
5. Special equipment engineering.
6. Constructing buildings, fences; providing standby power; erecting towers and antennas.

7. Integrating installation of microwave and mobile radio equipment; complete system.
8. Complete operational test and proof of performance prior to system "turn-over."
9. Training of customer personnel on the job and at the factory.
10. Single source control of completion date.
11. System installation programmed to meet your requirements for complete or partial system installation.
12. Choice of financing method.

MAIL COUPON FOR FURTHER INFORMATION

Tmk(s) ®

RADIO CORPORATION of AMERICA

COMMUNICATIONS PRODUCTS

CAMDEN, N. J.

Radio Corporation of America
Communications Products
Dept. E-45, Building 15-1, Camden, N. J.

☐ Please send me literature on the most modern form of Communications engineering . . . an RCA "Turnkey" Contract.

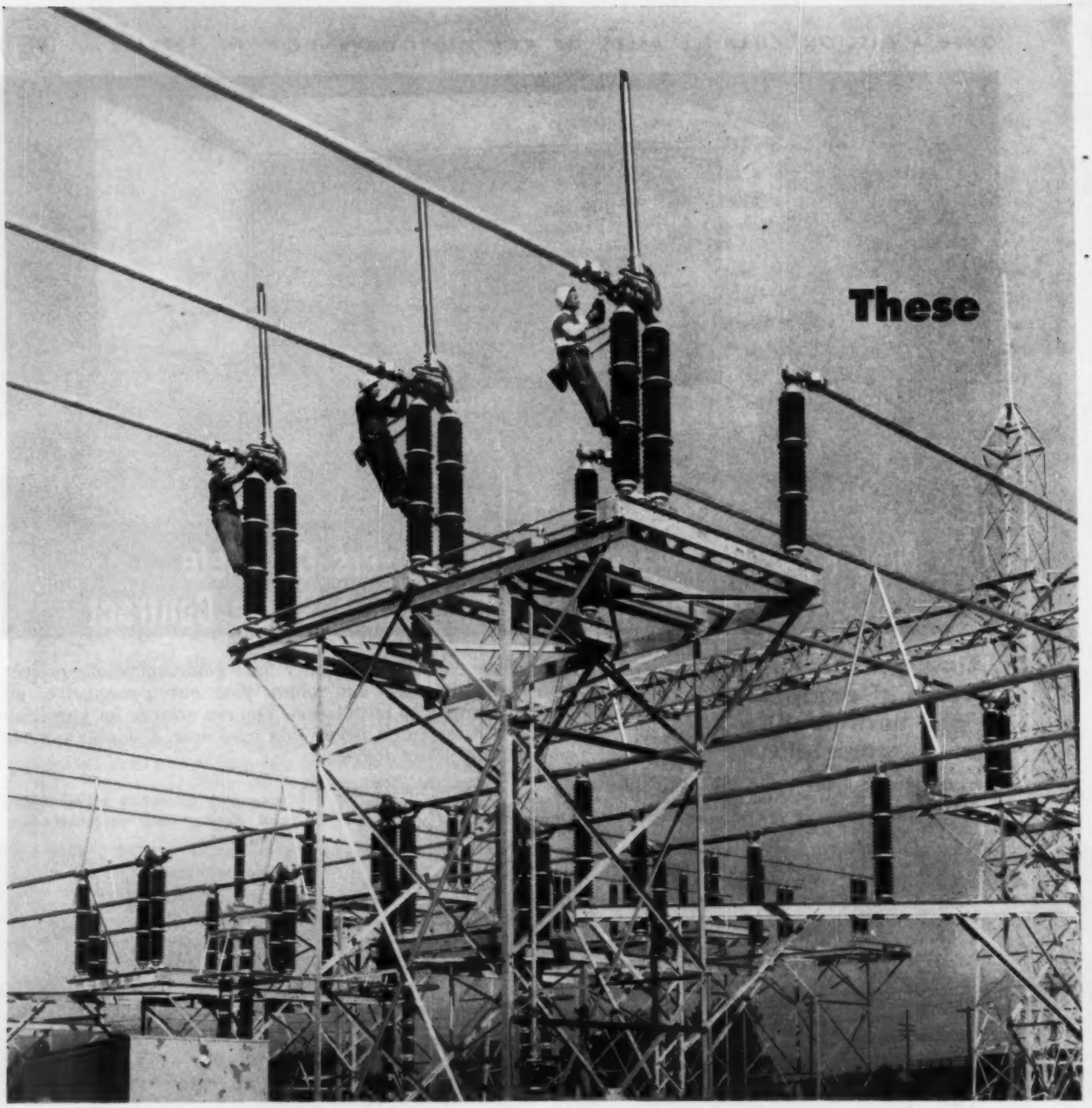
NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ COUNTY_____ STATE_____

☐ Please have RCA representative contact me.

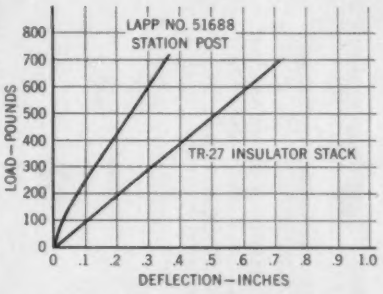


Part of 230 kv bus at Niagara Mohawk Power Corporation's Gardenville substation, planned for 600,000 kva ultimate capacity. Energized October, 1957. Insulators are Lapp High Strength Station Posts, No. 51688, 900 BIL.

230 kv switches will stay lined up

they're on Lapp Station Posts

Even if there weren't a dozen other good reasons, Lapp Station Posts could merit specification for high-voltage switch use on their superiority in *stiffness* alone. Fact is that, at all cantilever loadings, deflection of 230 kv Lapp Station Post is approximately 50% that of corresponding conventional pin-cap stacks (as indicated by deflection curve at right from laboratoty deflection measurements). This is easily understood when you consider the differences in these designs . . . the Lapp Station Post unit is a one-piece porcelain post with caps cemented at the ends in large-area, low-intensity compression grip . . . compared to the nested porcelain shells, internal pins, and high intensity tension-loading of stacking units. No wonder switches on Lapp Station Posts line up better under all loads . . . and operate better in all kinds of weather . . . throughout their life!

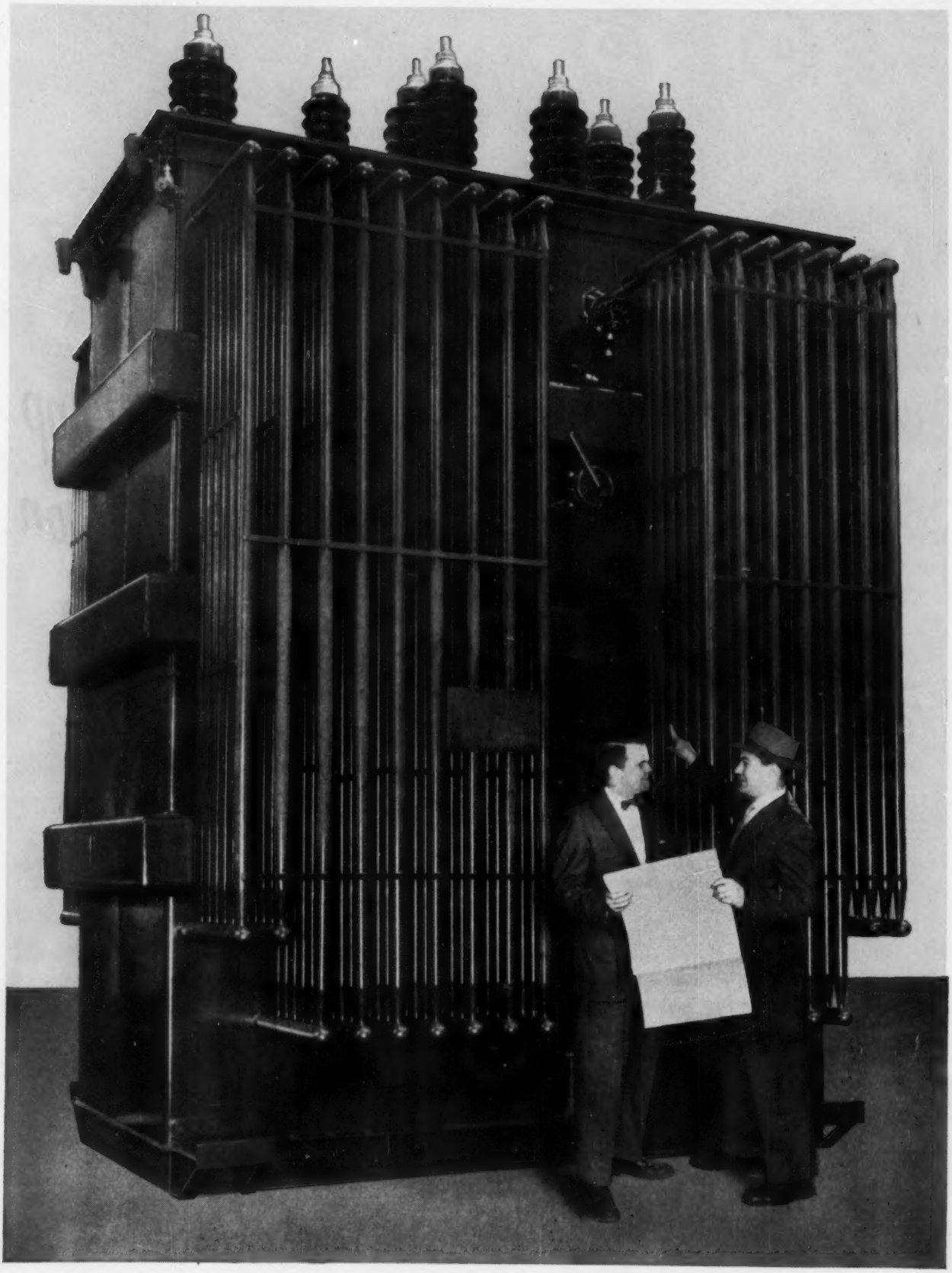


They go up easier, faster, too . . . assembled and installed with 16 bolts, as compared with 24 bolts required by a conventional 230 kv switch insulator. Weigh 30% less, too. Lapp Station Posts for 230 kv are available in two BIL ratings (900 kv withstand and 1050 kv withstand) and in three strength ratings . . . including new extra-high-strength that possesses cantilever values greater than those of any switch and bus insulators ever offered before at this voltage.

Look into the merits of Lapp Station Posts for your new construction at 230 kv (also at every other voltage from 7.5 kv to 385 kv . . . or higher). It will pay off in improved operating records, lower maintenance cost and longer life of your equipment.

Lapp Insulator Co., Inc., Le Roy, N. Y.

Lapp



INTRODUCING THE NEW '58

KUHLMAN POWER TRANSFORMER

Kuhlman presents a new standard line of power transformers in all ASA ratings, 501 through 10,000 KVA, single or three phase 69 KV and below.

The new line, representing five years of planning and research, offers the latest developments in modern transformer design. Here are some of the features that will reduce maintenance, improve efficiency, and lengthen the life of your substations.

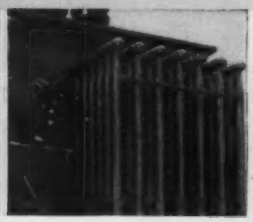
New Exterior Construction—features modern rectangular tanks, reinforced to give added strength—rounded, compact, cooling tubes for easier maintenance and maximum cooling in minimum space—sealed tanks to eliminate breathing, oil oxidation and moisture entrance.

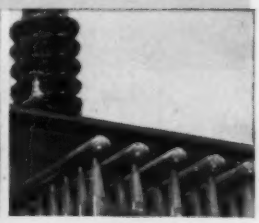
New Interior Construction—features smaller core and coil units of greater efficiency—rigid mechanical bracing of leads with ample electrical clearances—extra protection around line leads and end coils—sturdy pressure studs and steel clamping rings for holding coils solidly in place.

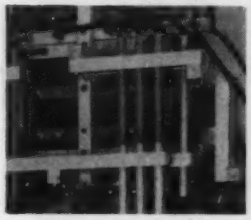
Also, stepped-back cruciform core for more compactness and freer oil circulation—self-aligning double-contact tap changer which locks in position—mechanically rigid core and coils braced to withstand vibrations and shocks in shipment and operation—strain-relief supports for tap leads.

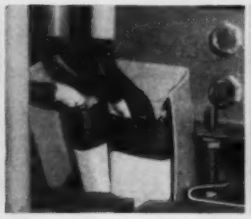
More Standard Accessories—structural steel base to allow skidding in two directions with easily accessible jacking lugs; design permits tipping up to 15° with the tank empty or filled with oil—easy to read instruments with dark face dials and light color markings for better visibility—upper and lower filter press connections for filtering while transformer is in operation; lower connection also includes a sampling device—and many other convenient accessories. (Provisions for forced cooling and non-standard accessories are supplied on request.)

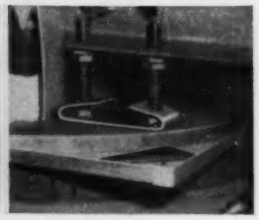
Heavy tank reinforcement

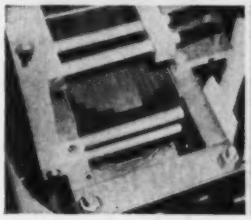

Compact cooling tubes

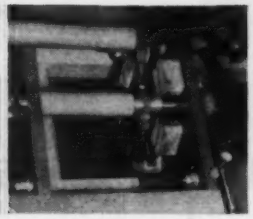

Welded covers (bolted covers supplied on request)

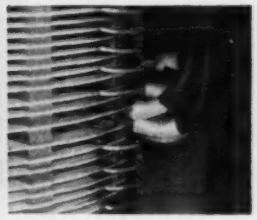

Rigid mechanical bracing

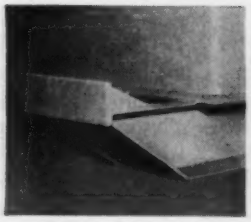

Protected leads

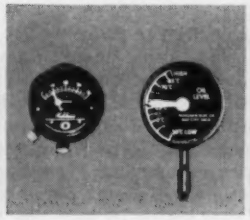

Pressure studs and clamping ring


Stepped-back core


Self-aligning tap changer


Supported tap leads


Skid base with jacking lugs


Easy to read instruments

Lower filter connection with sampling valve

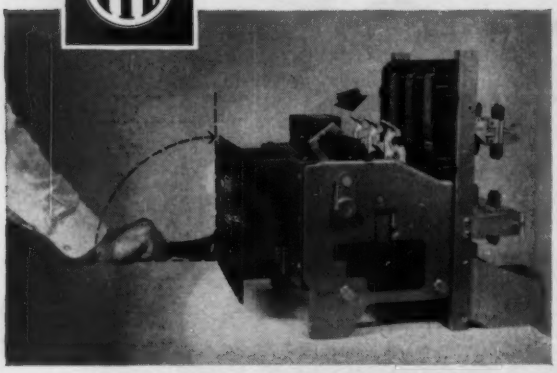
Ask your Kuhlman representative about all the features offered on the new improved Kuhlman power transformer. He'll gladly discuss your requirements and show you how Kuhlman's standard designs now assure faster delivery—to any point in the country.

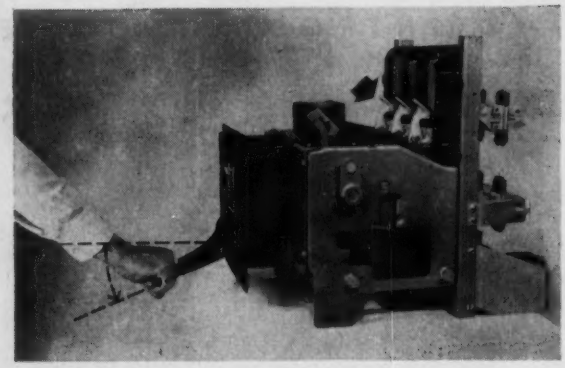
KUHLMAN POWER TRANSFORMERS

KUHLMAN ELECTRIC COMPANY General Offices: Birmingham, Michigan

BAY CITY, MICHIGAN • CRYSTAL SPRINGS, MISSISSIPPI • SALINAS, CALIFORNIA

K-LINE LOW VOLTAGE SWITCHGEAR

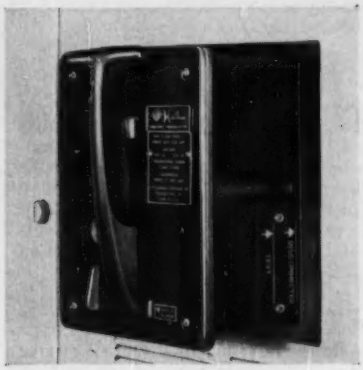




Only I-T-E has manual quick-make operation available in 225 through 1600 amp rating

Only handle moves. Contacts are static during first 90% of pulldown handle travel. In this picture, arc chutes are removed.

Too fast for the eye. When stored energy mechanism passes crossover point, energy is released to close contacts within 5 cycles.



Only I-T-E has doors closed in all positions while racking

With breaker connected. Both power and control separable contacts are engaged.

In test position. Power contacts disconnected —control contacts connected.

Completely disconnected. Both power and control contacts fully disconnected.

Quick-make, manually charged closing feature and drawout with doors closed provide maximum safety for operator and circuit breaker

You can't tease and burn the contacts of the new quick-make K-Line of circuit breakers—the closing action is fast and positive. An ingenious stored energy mechanism does the job. It stores energy in the first 90% of the pulldown handle travel, releases it in the last 10%. Not until the crossover point is reached do the contacts move. And it closes in only 5 cycles—provides uniform closure every time. *More important, it is the only manually charged stored energy circuit breaker available that will close and latch against its short-time rating.* This means greater safety for the operator, less maintenance, and longer contact life.

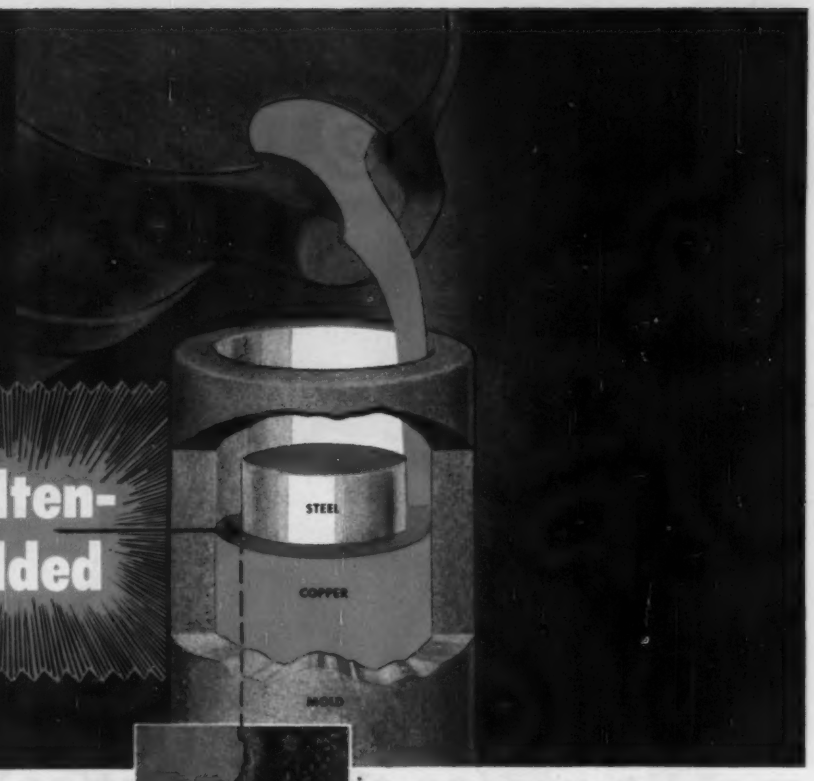
You don't have to open the door to move the circuit breaker to test or disconnected position. The crank which operates the simple drawout mechanism fits into the escutcheon through a lift shutter. The shutter cannot be lifted while the breaker is closed. The breaker cannot be closed while the shutter is lifted. This means more than greater safety—you can forget the dirt problem; the nuisance of open doors impeding aisle travel; the risk of circuit breaker damage from exposure, even when completely out of service.

Bulletin 6004-C gives complete information about the new and safer I-T-E K-Line of low voltage switchgear. Contact your nearest I-T-E sales office for a copy. Or write Switchgear Division, I-T-E Circuit Breaker Company, 19th & Hamilton Sts., Philadelphia 30, Pa. In Canada: Eastern Power Devices Ltd., Port Credit, Ont.

I-T-E CIRCUIT BREAKER COMPANY
PHILADELPHIA, PENNSYLVANIA

EVERY COPPERWELD GROUND ROD is

molten-welded



This microphotograph of the Molten-Weld shows how the grains of copper and steel interlock to form a permanent, continuous weld. No other process achieves this inseparable union.

WHAT'S THE ADVANTAGE?

By this unique Molten-Welding process—used only by Copperweld Steel Company—a uniformly thick sheath of pure copper is inseparably welded to an alloy steel core. Under carefully controlled conditions, the grains of both metals interlock to form a permanent, continuous weld. And from the moment of this union, Copperweld* performs as one metal. Hot rolling, cold drawing, temperature changes, pounding, or abuse cannot destroy the Molten-Weld in Copperweld Ground Rods.

WHAT DOES THE MOLTEN-WELD IN COPPERWELD MEAN TO YOU?

In service, this permanent Molten-Weld completely eliminates the possibility of harmful electro-galvanic action in the presence of moisture. There are no microscopic cracks, fissures, or pin holes in the thick copper exterior to admit moisture and give destructive rust a foothold.

So, for permanent grounding protection at lowest annual cost, insist upon Copperweld Ground Rods and get the rust resistance and conductance of copper plus the strength and easy-driving qualities of alloy steel. The time-tested dependability and economy of Copperweld products have been proved in service for over 40 years.

*Trade Mark

COPPERWELD STEEL COMPANY WIRE AND CABLE DIVISION *Glassport, Pa.*

For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

DRIVE DEEP with Copperweld TRADE MARK **sectional ground rods**

FOR low resistance THE YEAR 'ROUND

First transistor-powered mobile radios thermostatically protected

General Electric's Progress Line mobile radios now offer transistor advantages in all bands.

New transistorized power supply for both transmitters and receivers means no vibrators to replace, no rotating or vibrating parts to wear out. Transistors, plus high quality silicon rectifiers, give you the most dependable mobile communication known today.

Progress Line mobile radios with transistorized power supplies are available in *all* communication bands: 30 to 100 watts in low band (25-54 mc), 25 or 50 watts in high band (144-174 mc), or 15 watts in UHF band (450-470 mc).

OPERATE FROM EITHER BATTERY POLARITY—Only General Electric's Progress Line lets you operate on either positively or negatively grounded 12 volt batteries. This is especially important in fleet operations.

IMPROVED RANGE—Vibrator hash usually associated with receivers is totally eliminated by the use of transistors. The result is maximum receiver sensitivity.

NOT DAMAGED BY VOLTAGE VARIATIONS—Unlike vibrators, transistorized power supplies can withstand battery voltage variations from +20 to −50 percent.

PROGRESS WITHOUT OBSOLESCENCE—No need to buy new power cable or control head. General Electric Progress Line mobile units with either new transistorized power supply or regular vibrator power supply are *completely interchangeable.*

Call your G-E communications consultant for full details. He's listed under "Radio Communication Equipment" in the Yellow Pages. Or write General Electric Company, Communication Products Department, Section 2158, Syracuse, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

NEW!

T&B complete COLOR KEYED splicing package speeds line and service work

Now one new UT 5 installing tool is the *only* tool you need to make all line and service compression connections . . . including splicers, taps, and pin terminals. And T & B's color-keying insures accurate, speedy connections on a wide range of copper, aluminum and A. C. S. R. cable.
Here's all you do . . . match the color of the die to the color of the connector . . . compress . . . and the joint is made.

Your T & B Distributor will be glad to demonstrate the UT 5 with its many advantages. When you use this one tool you simplify all your line and service work. For further information write for new T & B bulletin.

LOOK FOR THIS SIGN — T&B ENGINEERED

IT'S THE MARK OF AN AUTHORIZED T & B DISTRIBUTOR
The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs. T-61

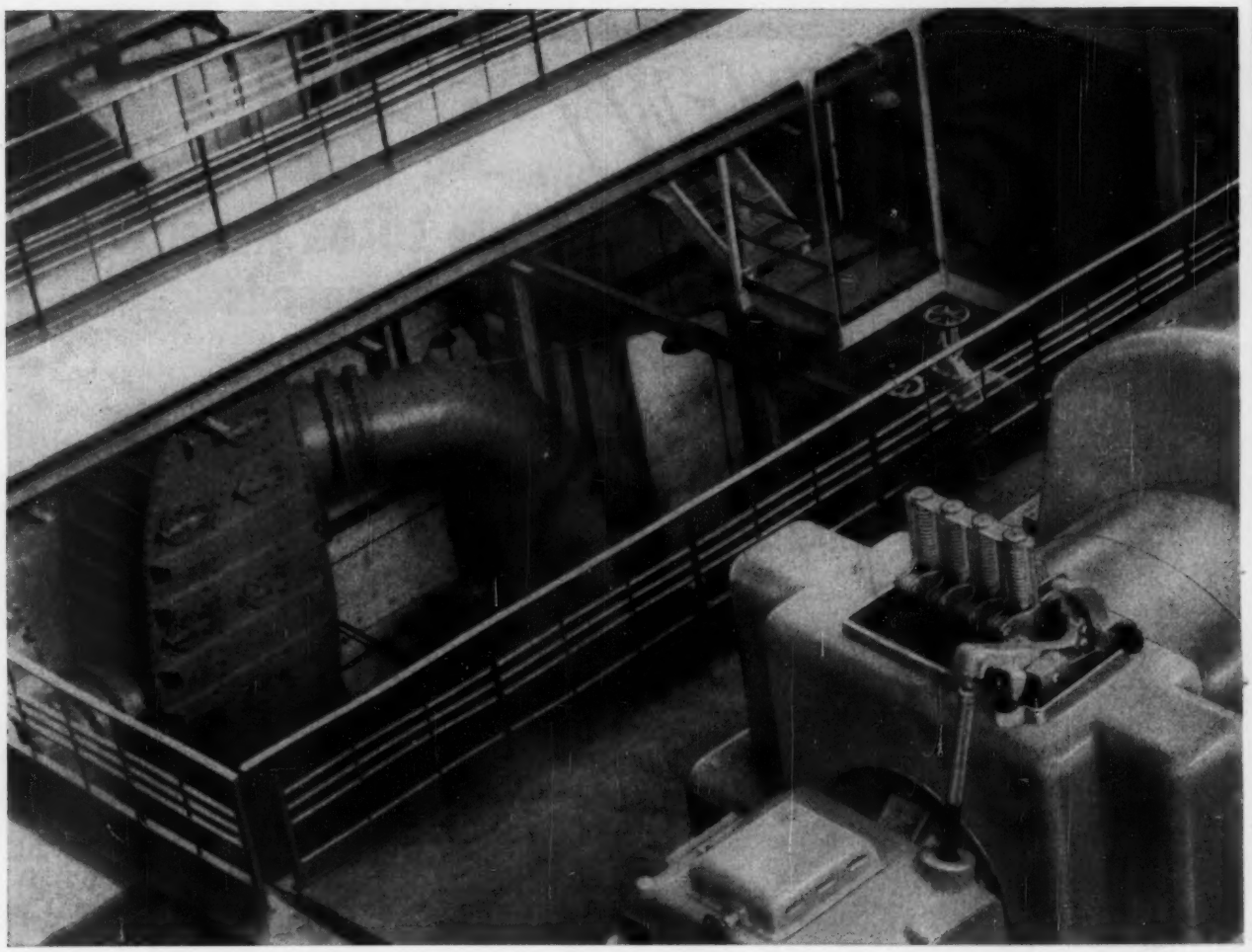
THE THOMAS & BETTS CO.

INCORPORATED
14 Butler Street • Elizabeth 1, New Jersey
Thomas & Betts Ltd., Montreal, P.Q., Canada
MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898

IN GULF'S MARKETING AREA . . .

More leading utilities depend on GULFCREST than on any other turbine lubricant

Georgia Power Company's Yates Plant has three 100,000 kw turbines and a 125,000 kw turbine working —protected by Gulfcrest. They'll soon add a fifth unit, a 125,000 kw turbine . . . and it will be filled with Gulfcrest, too. Each system holds 3,450 gallons of Gulfcrest, finest turbine oil available today!



In Gulf's marketing area, more power is generated by central station steam turbines filled with Gulfcrest than by units using any other lubricant.

Gulfcrest has an outstanding record for protection over the years. In many large turbines Gulfcrest has served continuously for 15 to 20 years with neutralization numbers low, systems free from sludge and rust.

The list of Gulfcrest users reads like a "who's who" of prominent utilities. To find out more about this superb, non-foaming, oxidation-resisting turbine oil ask a Gulf Sales Engineer. Call your nearest Gulf office, or write us for new, illustrated Gulfcrest bulletin, just off the press.

NINE DIFFERENT STEPS, INCLUDING GULF'S EXCLUSIVE ALCHLOR PROCESS, TO PRODUCE GULFCREST!

Gulf, as one of the largest crude oil producers, can select the finest crudes as base oil.

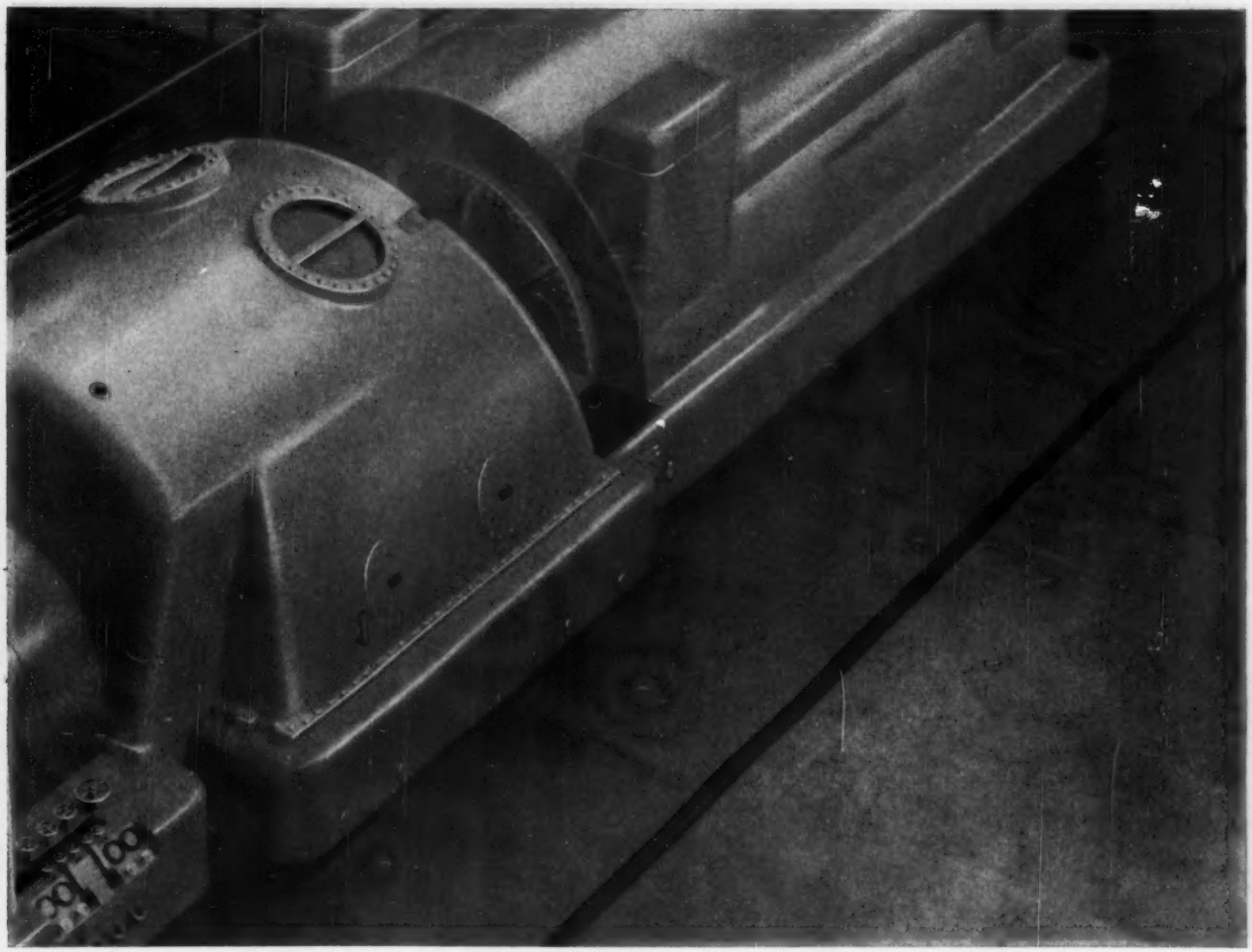
The base oil is first distilled, then put through propane de-asphalting, refined with phenol, de-waxed, fractionated, *super-refined by the Alchlor Process,* processed by clay contacting and filtered.

Only then is it ready for proper additives . . . and Gulf leads in the development of more effective turbine oil additives!

GULF OIL CORPORATION
Dept. DM, Gulf Building
Pittsburgh 30, Pa.

GULF

THE FINEST PETROLEUM PRODUCTS FOR ALL YOUR NEEDS



HERE'S A
SPECIAL ADVANTAGE
OF THE
LJUNGSTROM:®

high availability

These five basic factors assure you that the Ljungstrom Air Preheater will give exceptionally long periods of uninterrupted availability:

1. UNIFORMLY HIGHER COLD-END METAL TEMPERATURES. This minimizes the danger of local corrosion due to cold spots.

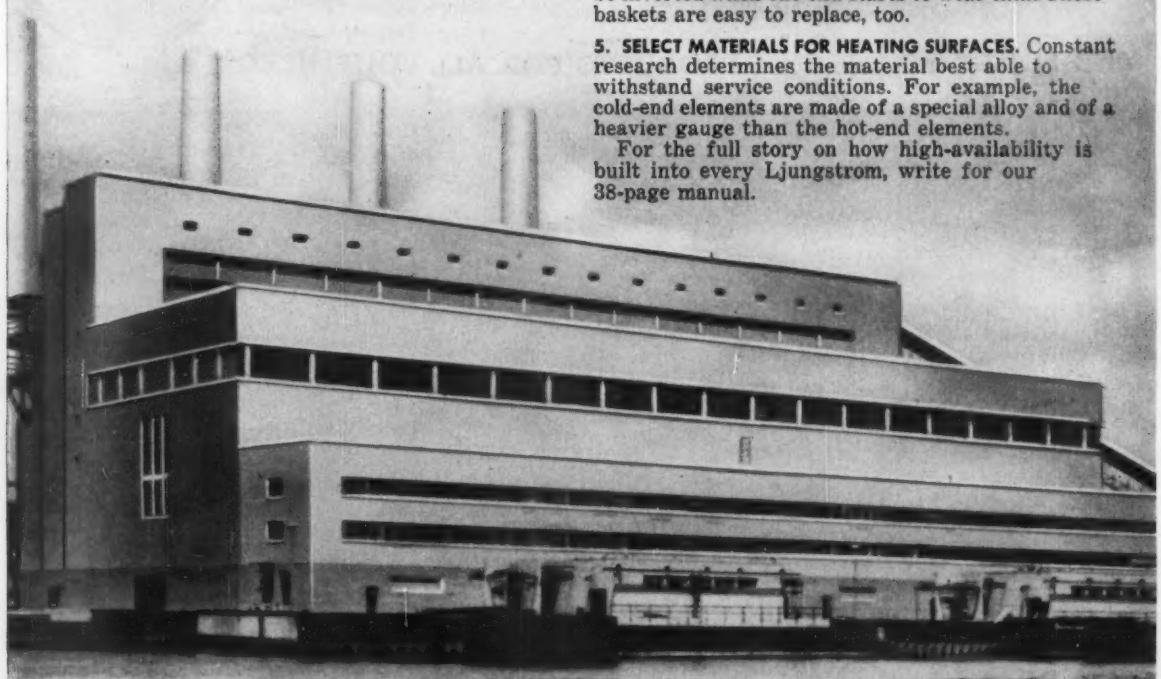
2. POSITIVE CLEANING ACTION. A mass-flow soot blower is normally installed at the cold end of the Ljungstrom where deposits are most apt to accumulate. Daily cleaning with superheated steam or compressed air removes any deposits.

3. INSPECTION PORTS. You can see for yourself, at any time, the condition of the heating surfaces.

4. REVERSIBLE COLD-END BASKETS. Elements in the cold end are separated into small baskets, which can be inverted when one end starts to wear thin. These baskets are easy to replace, too.

5. SELECT MATERIALS FOR HEATING SURFACES. Constant research determines the material best able to withstand service conditions. For example, the cold-end elements are made of a special alloy and of a heavier gauge than the hot-end elements.

For the full story on how high-availability is built into every Ljungstrom, write for our 38-page manual.



The Air Preheater Corporation 60 EAST 42nd STREET, NEW YORK 17, N. Y.

Right off the Wire

No. 4 in a series

Power for earth satellites could be supplied by a new chemical battery that uses a dye to convert sunlight into electricity.

&

A new bearing metal of tin and aluminum is said to combine the bearing qualities of one with the light weight of the other.

&

Negatively ionized air is being used as a painkiller for patients with severe burns. After two exposures of twenty minutes each no narcotics are needed.

&

Users of High Voltage cables should note that high molecular weight polyethylene can be expected to have a voltage life about seven times that of standard polyethylene. (From paper on Dielectric Strength and Voltage Life of Polyethylene, presented at AIEE Winter General Meeting, February 1958, by Messrs. Hunt, Ware and Koulopoulos of Simplex.)

&

A new, automatic door opener is installed overhead, like a door check, and requires no complex, under-floor wiring. It can be installed in a few hours.

&

In a new cook stove the heat is generated in the utensil by putting it in a magnetic field. No heat is wasted and spilled food does not burn. It is said to be faster than ordinary electric stoves.

&

The "cage zone" melting system has proved successful in purifying niobium. Under high vacuum the metal is melted by high frequency current and the impurities separate to be cut off later.

&

A vinyl lining material for swimming pools of masonry or wood is in the form of sheeting with an adhesive back that sticks to the sides and assures complete waterproofing.

To meet the growing demand for power by industry, Simplex has installed new equipment that allows cable cores of greatly increased diameters to be armored with CONDEX, the interlocking armor tape made by Simplex since 1924.

&

Printed pages can actually be made to talk by means of a Japanese invention. The back of the paper is treated like magnetic tape and produces recorded sounds when a reproducing head is passed over the printed words.

&

Further information on these news items and on Simplex cable is available from any Simplex office. Please be specific in your requests.

&

A new, thirty-nine-passenger bus for intercity service is claimed to have many advantages. It has a flat floor (no step-up to seats), a "recreation area," lavatory, reclining seats and air suspension.

&

The size of electrical components may be further reduced by a process for putting tiny germanium transistors into printed circuits.

&

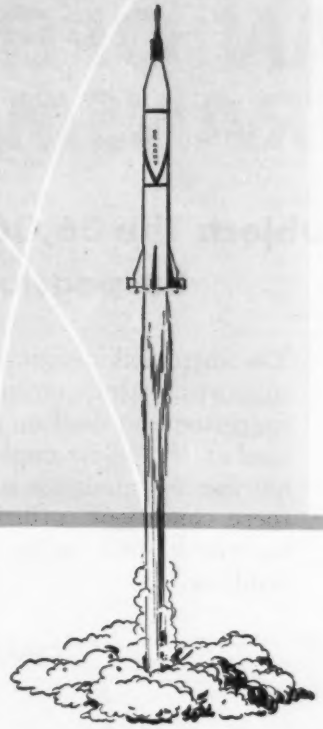
Buildings are being erected with the use of balloons instead of derricks.

&

A method of projecting color pictures on a screen from black and white slides has been discovered.

&

An acknowledged leader of the cable industry in research and manufacturing skills, Simplex scientists and engineers present technical papers on a variety of subjects of interest to users of insulated cables. A list of papers read before the AIEE and other associations will be sent on request.



Underwater nerves take the "miss" out of missiles

Test rockets fired from the U. S. Air Force Test Range in the Bahama Islands are tracked electronically from a series of check points along their routes. This close observation detects the slightest variance from the missiles' intended flight path. The vital communications link for this work is a 1400-mile Simplex submarine cable to Puerto Rico — a product of the world's most modern techniques in under-water cable manufacture.

For high voltage power transmission or the most exacting communications cables, Simplex' research, engineering and manufacturing facilities are at your service.

SIMPLEX WIRE & CABLE CO.
Cambridge, Massachusetts and
Newington, New Hampshire

Simplex

Highest quality cables for: Mining
Power & Lighting • Construction
Transportation • Communications
Signalling

"*the American manufacturers of transoceanic telephone cables*"

GENERAL ELECTRIC COMPANY

INSULATOR DEPARTMENT

AN OPEN LETTER TO THE TRANSMISSION ENGINEER

Subject: The 36,000 lb. Ball and Socket Suspension Insulator and What It Will Do for YOU!

The increased design tensions of today's larger conductors are making insulator supporting arrangements correspondingly complex. In fact, the conductors being suggested and used on many of the new bundled lines are *larger than many of those used on the largest single conductor* applications of five or ten years ago. As a result, hot line maintenance is more difficult and assembly costs are excessive. To combat these conditions, utilizing our new high strength, high impact ceramic body, we have developed the **No. 18360, the industry's first 36,000 lb. ball and socket suspension insulator.**

CHARACTERISTICS

Diameter, Inches	10
Unit Spacing, Inches	5¾
Leakage Distance, Inches	11
Inches of leakage distance per inch of spacing	1.91
Mech. & Elec. Strength, Lbs.	36,000
Routine Proof Test Load, Lbs.	18,000
Mechanical Impact Strength, Inch-Lbs.	100
Net Weight, Lbs.	15

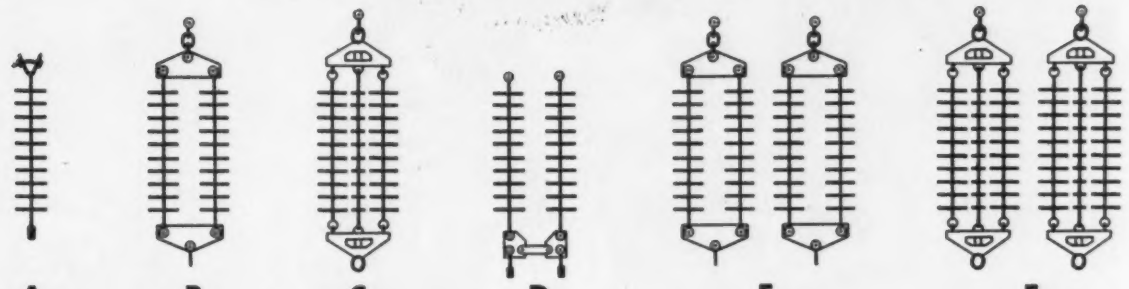
*Locke Cat. No. 18360

THIS NEW UNIT CAN HELP *YOU*!

We have made a tabulation of several arrangements showing some of the benefits of the No. 18360 and associated hardware. The relative cost of arrangement "A" (when using 25,000 pound units) shown at right is 100. In this tabulation we have used average Installation and Hot Line Maintenance Costs. Note that as conductor design tensions go up, so do the advantages of the 36,000 pound insulator. **Prove for yourself,** using your own costs, the dollar benefits of this new unit in fulfilling your present and future transmission requirements.

*Trademark General Electric Co.

SINGLE AND BUNDLED CONDUCTOR ARRANGEMENTS



A Single String Strain Assembly

B Double String Strain Assembly

C Triple String Strain Assembly

D Single String Two Conductor Strain Assembly

E Double String Two Conductor Strain Assembly

F Triple String Two Conductor Strain Assembly

TABLE OF TYPICAL APPLICATIONS

Insulator M & E Strength Rating—Lb.	Maximum Recommended Load—Lb.	Conductor Design Tension—Lb.	Arrangement (Figure)	Relative Material Cost*	Relative Installation Cost*	Total Relative Cost*	Relative Hot Line Maintenance Cost**
SINGLE CONDUCTOR							
15,000	7,500	12,500	B	170	105	275	45
25,000	12,500		A	100	65	165	30
36,000	18,000		A	200	70	270	30
15,000	7,500	15,000	B	170	105	275	45
25,000	12,500		B	220	110	330	45
36,000	18,000		A	200	70	270	30
15,000	7,500	18,000	C	340	140	480	50
25,000	12,500		B	220	110	330	45
36,000	18,000		A	200	70	270	30
BUNDLED CONDUCTOR—TWO CONDUCTORS							
15,000	7,500	12,500	E	345	200	545	60
25,000	12,500		D	210	120	330	50
36,000	18,000		D	420	130	550	50
15,000	7,500	15,000	E	345	200	545	60
25,000	12,500		E	445	210	655	60
36,000	18,000		D	420	130	550	50
15,000	7,500	18,000	F	680	260	940	80
25,000	12,500		E	445	210	655	60
36,000	18,000		D	420	130	550	50

Use your **own** costs. **Prove** these benefits for your system.

A CHOICE OF FITTINGS IS AVAILABLE

Our complementary line of 36,000 lb. insulator connecting hardware can be used with existing high strength links, turnbuckles, straps, etc. This provides you a wide choice of tower or pole top arrangements. **In the interests of interchangeability,** we have made these designs available to the industry.

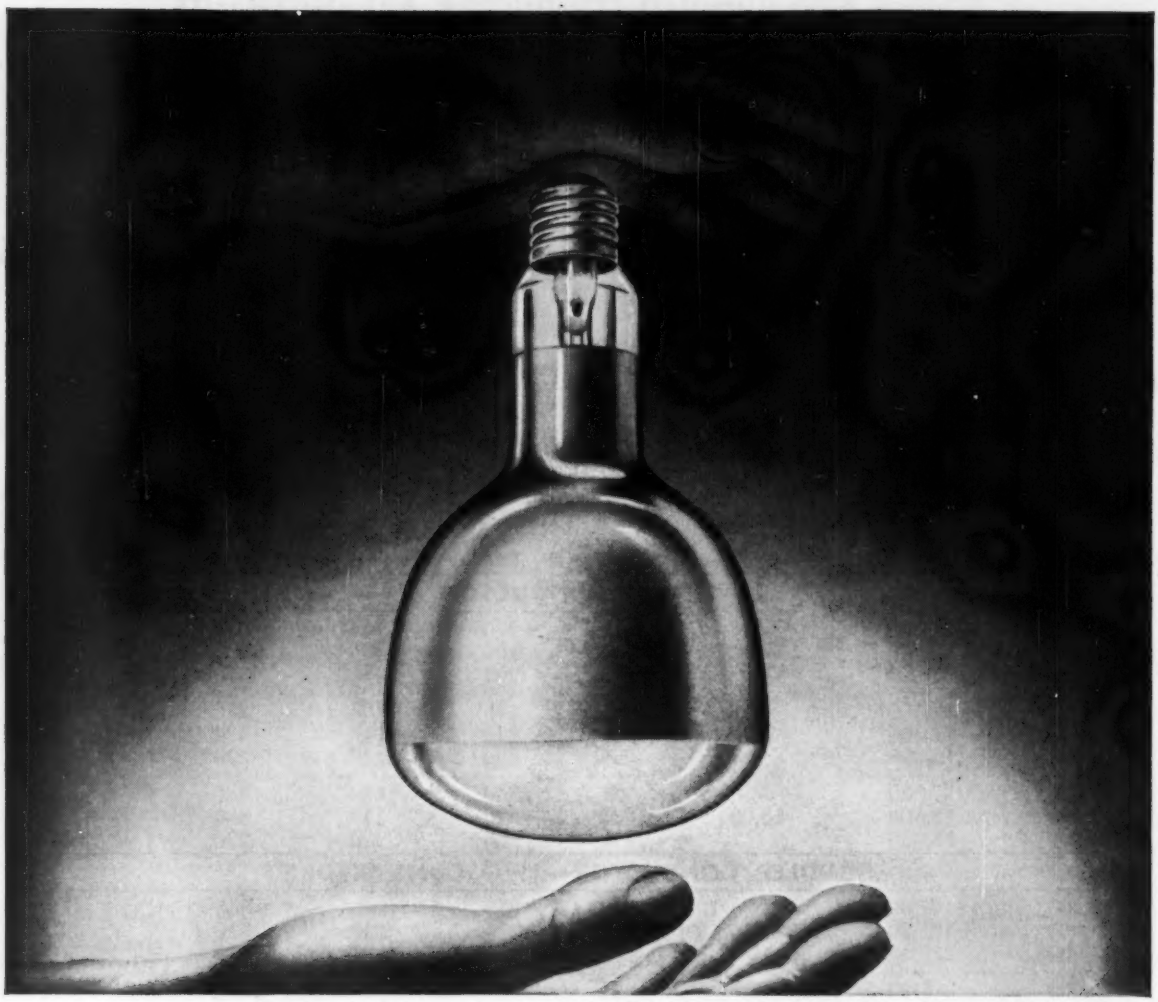
We sincerely believe this new 36,000 lb. ball and socket insulator and its associated hardware represents an economic tool for you—the transmission engineer.

For additional information on our 36,000 lb. insulator or any of our new high strength designs, write to the Insulator Department, General Electric Company, P.O. Box 57, Baltimore 3, Maryland.

Joseph Kaminski, Jr
Product Engineer

*Relative costs based upon 15 unit string. Same ratios can be used with only slight changes for comparing equal strings of 10 to 20 units.

**Relative maintenance costs are for changing by hot line methods a single insulator unit in each of the above arrangements.



Sylvania's R-52 lamp has a sealed-in reflector that never dims . . . produces more light where you want it . . . makes costly fixture care unnecessary.

All downward **working** light—no upward **wasted** light . . . with this Sylvania reflector lamp

Sylvania's R-52 reflector lamp has helped industrial plant management to effect important lighting economies, and achieve greater lighting efficiency.

The R-52 reflector lamp is a "high-bay" lamp particularly suited to overcome plant conditions of severe dirt, grease and smoke. Its *sealed-in aluminized* reflector is 100% dirt-proof . . . eliminates the need for costly, time-consuming fixture-cleaning . . . and provides greater efficiency throughout the life of the lamp.

As an integral part of the Sylvania R-52, the reflector is angled to concentrate a maximum of usable working light downward . . . helps increase productive efficiency . . . and provides more useful light for the same wattage.

R-52 reflector lamps are available in 500- and 750-watt sizes. Your Sylvania Supplier will gladly demonstrate their efficiency and advantages. Call him for complete information, or write:

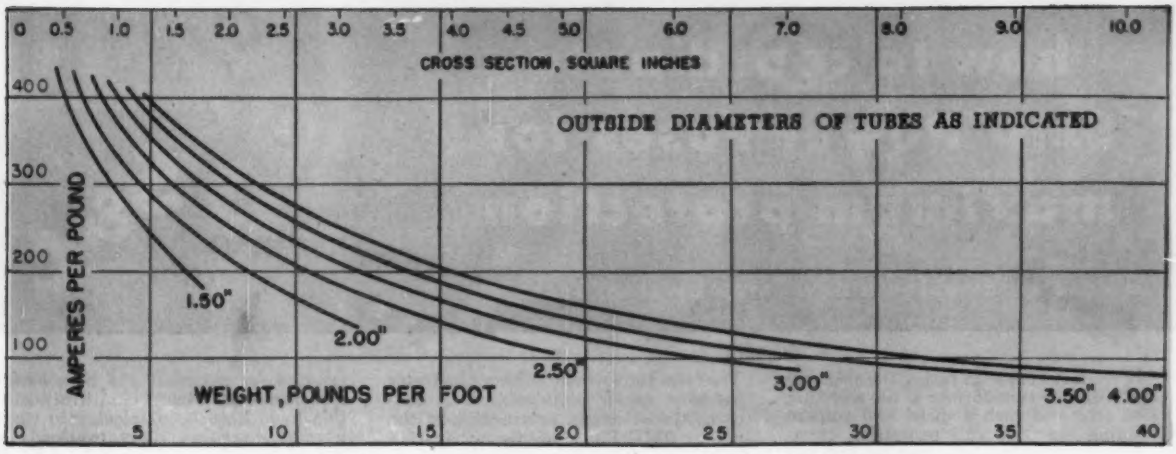
SYLVANIA ELECTRIC PRODUCTS INC.
Lighting Division, Dept. 8L-7604
60 Boston Street, Salem, Mass.

In Canada:
Sylvania Electric (Canada) Ltd.
Shell Tower Building, Montreal

SYLVANIA

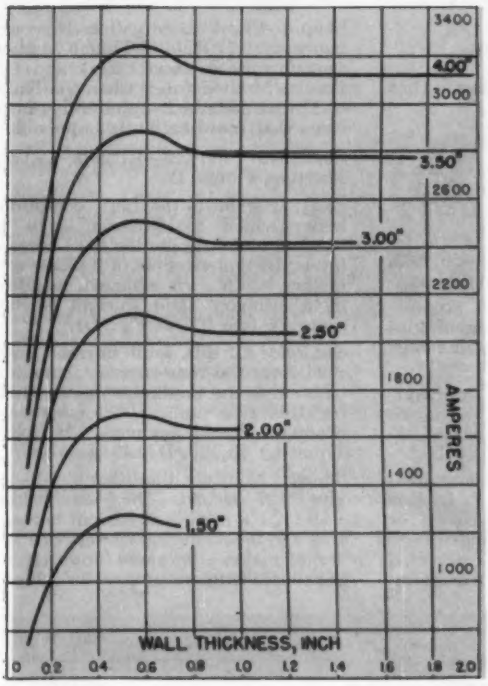
. . . the fastest growing name in sight

LIGHTING • RADIO • ELECTRONICS • TELEVISION • ATOMIC ENERGY



60-CYCLE CURRENT ratings of six round copper tubes in terms of weight per foot.

How to carry more amperes per pound of copper



THE INFLUENCE of wall thickness on the 60-cycle current rating of six round copper tubes.

THIN-WALL TUBES with low wall-thickness-to-diameter ratio offer decided electrical advantages—and opportunities for cutting bus costs—wherever mechanical requirements permit. The charts above and at the left show the 60-cycle skin-effect phenomenon characteristic of six representative sizes of round copper tube, 1.5" to 4.0" O.D. The curves cover the entire range of wall thickness from solid round rods, at the right, to the thin-walled tubes in common use at the left. What is true of round tubes is also true of other tubular bus shapes.

INSTALLATION ECONOMIES. When round tubular bus conductors can be selected in thin-wall sizes from the standard pipe dimension schedules, it is possible to effect further economies by the use of stock sizes of supports, connectors, tap clamps, and other necessary hardware available in great variety in dealers' stocks.

More complete information on tubular conductors is available in the Sixth Edition of The American Brass Company's Publication C-25. This 62-page booklet has a wealth of general information on the properties of copper conductors—plus convenient data for the most commonly used sizes of all types of rigid bus conductors.

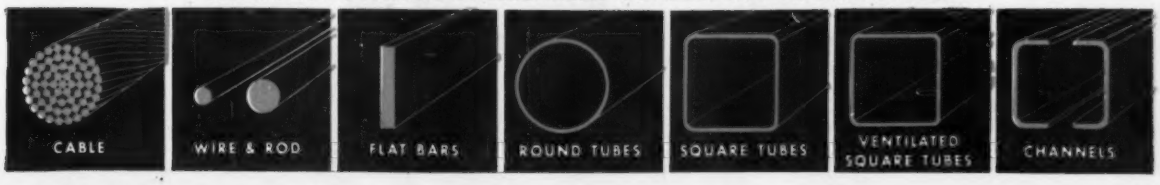
TECHNICAL SERVICES. Anaconda specialists are available to help you in the solution of technical problems involving the use of Anaconda Bus Conductors. For such service, or for a copy of Publication C-25, see your nearby Anaconda representative. Or write: The American Brass Company, Waterbury 20, Conn. 57100

ANACONDA®

COPPER CONDUCTORS

Made by The American Brass Company

THERE'S AN ANACONDA ELECTRICAL CONDUCTOR FOR EVERY NEED



how to coordinate SMD Power Fuses for maximum protection

a case study using a new "step-by-step" technique

A common error in fusing the primary of a power transformer is the selection of a fuse of such a speed and ampere rating that the full protection capability of the modern fuse is not put to use.

Properly selected, a modern power fuse can provide for

1. system protection,
2. transformer protection against secondary faults, even line-to-ground,
3. use of transformer short-time daily overload capability,
4. use of transformer short-time emergency overload capability, and
5. complete and precise coordination with other overcurrent devices.

The selection of the right fuse, however, has not been easy, since there has been until now no commonly and consistently agreed upon method of coordination; and only meager information about fuse performance has been available.

Consequently, a new "step-by-step" method for power fuse coordination has been developed by S&C. Supported with all necessary power fuse performance data, this method utilizes the full protection capability of the *modern* power fuse; furthermore, it lends itself to general acceptance and universal use because its development was based on the realistic recognition of

1. the duties the user desires to impose today on a power fuse, and
2. the contradictions in power fuse selection work—the need for simplicity on the one hand and the need for precision on the other.

The case study which follows illustrates the new step-by-step method. It concerns the selection, specifically, of the proper SMD Fuse Unit for application on a power transformer primary.

• • • •

Case Data:

Transformer Bank:
7500 kva, 3-phase, self-cooled.
Primary voltage: 69 kv delta
Secondary voltage: 7.2/12.47 kv wye

Short Circuit Maximum:
Primary: 750,000 kva
Secondary: 80,000 kva (bus fault)

Secondary Breaker:
Ampere Rating: 1200
Reclosing Time: 10-40-100 sec.
Relay-breaker characteristic shown by curve, Figures D and G

Procedure:

Using the S&C Data Bulletin 262, open the front cover to the step-by-step outline shown in Fig. A.

Step 1: Select voltage rating of fuse to equal or to exceed line-to-line voltage of the system—69 kv.

Step 2: Check for adequate interrupting rating (Fig. B). Since the maximum available short-circuit is 750,000 kva, the correct fuse unit is SMD-2.

Step 3: Establish the minimum ampere rating of the fuse unit. In this case use the table for self-cooled or water-cooled power transformers (Fig. C). *(Similar tables are provided for forced-air-cooled power transformers and for potential and distribution transformers.)* The fuse unit ratings in this table have been selected to carry normal short-time daily overloads of the magnitudes established by ASA in the publication, "Guide for Loading Oil-Immersed Distribution Transformers and Power Transformers." No *additional* allowance need be made. Per Fig. C under the proper voltage (69 kv) and proper kva (7500), the correct fuse unit ampere rating is 100E.

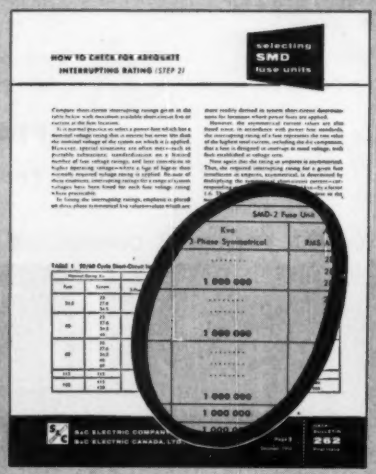
Step 4: Check coordination. Here are two ways: (1) Rule-of-Thumb Method (satisfactory in most cases) and (2) Precise Method (used when the Rule-of-Thumb Method apparently indicates that coordination is impossible).

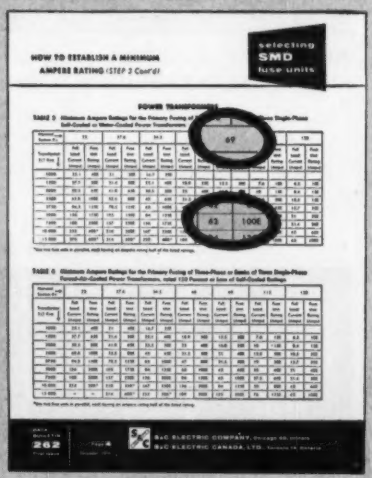
SECONDARY FAULTS—RULE-OF-THUMB METHOD, FIGURE D.

First: Establish the fault conditions under which coordination is to be checked and compute the fault current levels. In this example, a 3-phase secondary bus fault is assumed, resulting in a primary fault current of 680 amperes (see ① in Fig. D).

Second: At this fault current level, read from the time-current characteristic curve the minimum melting time for this fuse unit, 100E amperes—Standard Speed assumed. This gives Point ② in Fig. D 0.49 seconds.

Third: Multiply this time by .55—to give 0.27 seconds—thus establishing Point ③ a minimum margin between fuse and breaker-relay curves. The factor .55 makes allowances for variations in ambient temperature and for full pre-





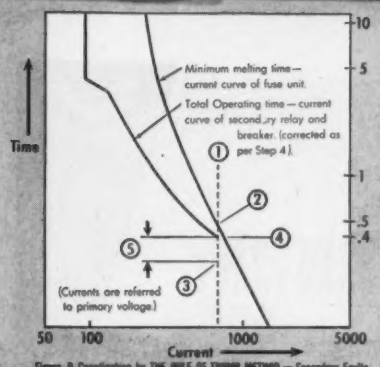

Time
Minimum melting time—current curve of fuse unit.
Total Operating time—current curve of secondary relay and breaker. (corrected as per Step 4.).
(Currents are referred to primary voltage.)
Current
50 100 1000 5000
10 5 1 .5 .4

Figure B. Coordination by THE RULE-OF-THUMB METHOD — Secondary Faults

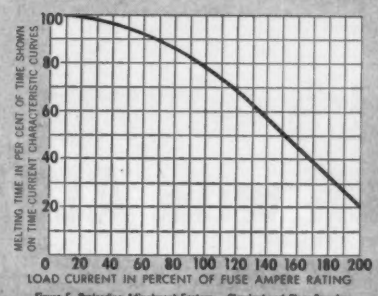

MELTING TIME IN PER CENT OF TIME SHOWN ON TIME-CURRENT CHARACTERISTIC CURVES
100 80 60 40 20
0 20 40 60 80 100 120 140 160 180 200
LOAD CURRENT IN PERCENT OF FUSE AMPERE RATING

Figure E. Preloading Adjustment Factors—Standard and Slow Speeds

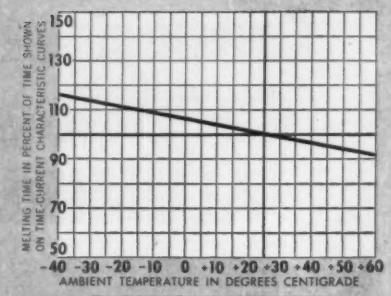

MELTING TIME IN PERCENT OF TIME SHOWN ON TIME-CURRENT CHARACTERISTIC CURVES
150 130 110 90 70 50
-40 -30 -20 -10 0 +10 +20 +30 +40 +50 +60
AMBIENT TEMPERATURE IN DEGREES CENTIGRADE

Figure F. Ambient Temperature Adjustment Factors

loading of the fuse, even from daily overloading of the transformer bank.

Fourth: Read from total operating time-current characteristic curve of secondary relay-and-breaker the operating time, Point ④ for this current level—0.40 seconds.

Conclusion: Coordination is not obtained since the time of Point ④ exceeds that of Point ③.

The next step is to recheck coordination, assuming a *Slow Speed* 100E ampere fuse unit. Here again, using the Rule-of-Thumb Method, coordination is not obtained. At this point, rather than to select a higher ampere rating which would sacrifice transformer protection, recheck coordination by the Precise Method.

SECONDARY FAULTS—PRECISE METHOD (an alternate to the Rule-of-Thumb Method), FIGURE G.

This method involves a comparison of the time-current characteristic curves of the selected fuse unit and the secondary breaker-and-relay *after both curves have been corrected* for the various factors that affect coordination. (See Fig. G below.) Factors for correcting relay and breaker curves are obtained from relay and breaker manufacturers.

The factors which apply to the fuse units are discussed below. They are:

- Adjustment for Preloading (see Fig. E above)
- Adjustment for Ambient Temperature (see Fig. F above)
- Allowance for the effect of cumulative heating and cooling of the fuse element during successive breaker operations (heating while short-circuit current flows, then cooling between breaker operations). Where the open-circuit time interval is less than ½ second, no allowance for cooling of the element is necessary; where the interval is 2 seconds or more (as it is in this case), the element will cool to a degree where cumulative heating need not be considered. (For intervals between ½ and 2 seconds, the full details on cooling time allowances are found in Data Bulletin 262.)

In this particular fusing problem, coordination with the secondary breaker-and-relay has been obtained by the Precise Method, since, in Fig. G, the time ② on the corrected fuse curve is greater than the total relay-breaker time ③ for this current level. This difference is indicated by ④. Were this not the case, using a Standard Speed Fuse unit, then a recheck would be made, using a fuse unit of the same ampere rating but Slow Speed. Do this rather than going to a higher ampere rating, since a higher rated fuse unit offers less protection to the transformer. If the Slow Speed does not coordinate satisfactorily, *then* recheck, using the next higher ampere rating in the Standard Speed.

PRIMARY FAULTS, FIGURE H.

For both Rule-of-Thumb and Precise Coordination Methods the same practice is used. No adjustments or margins are required. Coordination will be obtained where the total clearing time of the fuse unit ③ is equal to or less than the tripping time ② of the line breaker relay. ④ Indicates margin.

Step 5: Check for Short-Time Emergency Overload Operation.

These curves (Fig. I) show the ability of an SMD Fuse Unit to carry emergency overloads after carrying rated load. This overload situation arises, for example, when one transformer on a duplex substation is out of service for repairs or maintenance, putting the entire load on the other transformer and its fuses. The curves are based on an ambient of 30°C and represent the maximum *nonrepetitive* overload (in per cent of ampere rating) that an SMD Fuse Unit can carry for a given time without impairing its ability to perform properly. For each degree above or below 30°C, the capability may be adjusted 0.3 per cent.

• • • •

The above case study is a brief summary of a fusing problem solved by using the complete 12-page Data Bulletin 262 entitled, "Selecting SMD Fuse Units," published by S&C Electric Company. This bulletin with 8 Time-Current Characteristic Curves and a comprehensive text on coordination is yours for the asking.

S&C Electric Company, 4421 Ravenswood Avenue, Chicago 40, Ill. In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto, Ontario.

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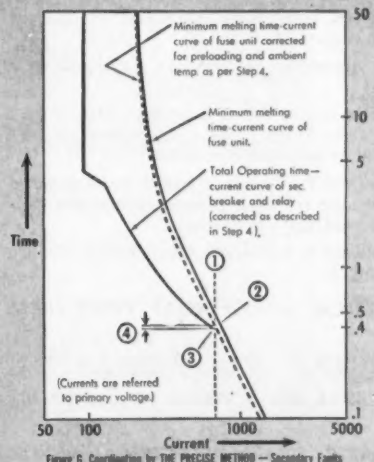

Time
Minimum melting time-current curve of fuse unit corrected for preloading and ambient temp. as per Step 4.
Minimum melting time-current curve of fuse unit.
Total Operating time—current curve of sec. breaker and relay (corrected as described in Step 4.).
(Currents are referred to primary voltage.)
Current
50 100 1000 5000
50 10 5 1 .5 .4 .1

Figure G. Coordination by THE PRECISE METHOD — Secondary Faults

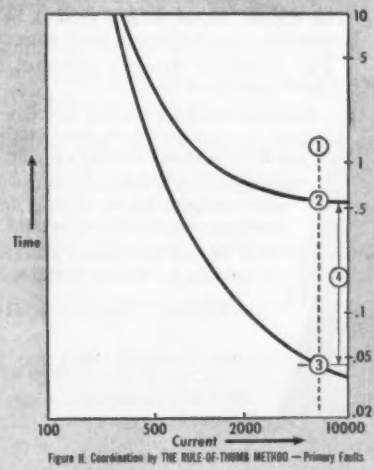


Figure H. Coordination by THE RULE-OF-THUMB METHOD — Primary Faults

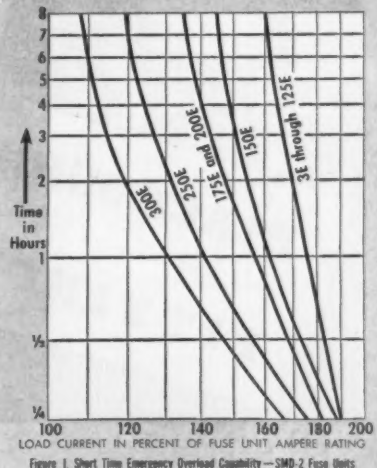

Time in Hours
8 7 6 5 4 3 2 1 ½ ¼
300E
250E
175E and 200E
150E
3E through 125E
100 120 140 160 180 200
LOAD CURRENT IN PERCENT OF FUSE UNIT AMPERE RATING

Figure I. Short Time Emergency Overload Capability—SMD-2 Fuse Units

Connect
COPPER with COPPER
ALUMINUM with ALUMINUM
use...

PAC-5
ACSR 6—1/0 Cu. 8—1/0

PAC-3
ACSR 8—2 Cu. 8—2

PAC-4
(formerly PAC 6—0)
ACSR 6—1 0 Cu. 6—2

PAC-7 (replaces PARC 6—0)
ACSR 1 0—336.4
6—1 0 A R Cu. 8—1 0

BLACKBURN COPPER TO ALUMINUM FITTINGS

BLACKBURN PAC CLAMPS

ELIMINATE CORROSIVE SOLDERS, VOIDS AND FLUXES !

There are many satisfactory copper connectors for connecting copper conductors.

There are many satisfactory aluminum connectors for connecting aluminum conductors.

Blackburn's PAC clamps combine the features of a good copper connector and a good aluminum connector to give you the best copper to aluminum connector available.

Our exclusive method (Patent applied for) of pressure casting molten corrosion resistant aluminum alloy around specially treated pronged copper liners establishes an intimate, low resistance contact of the two metals without using corrosive solder.

The copper liners, which cannot be mated incorrectly, surround the copper conductor establishing a good copper to copper contact.

The aluminum grooves surround the aluminum conductors, establishing a good aluminum contact.

Adequate contact surface and conductor separation is built into Blackburn's PAC clamps to insure long-lasting, trouble-free copper to aluminum connections without setting up cold flow or galvanic corrosion.

Spring action is inherent in the design of PAC clamps and is supplemented with an extra-heavy spring lockwasher insuring permanently tight connections which will withstand temperature fluctuations.

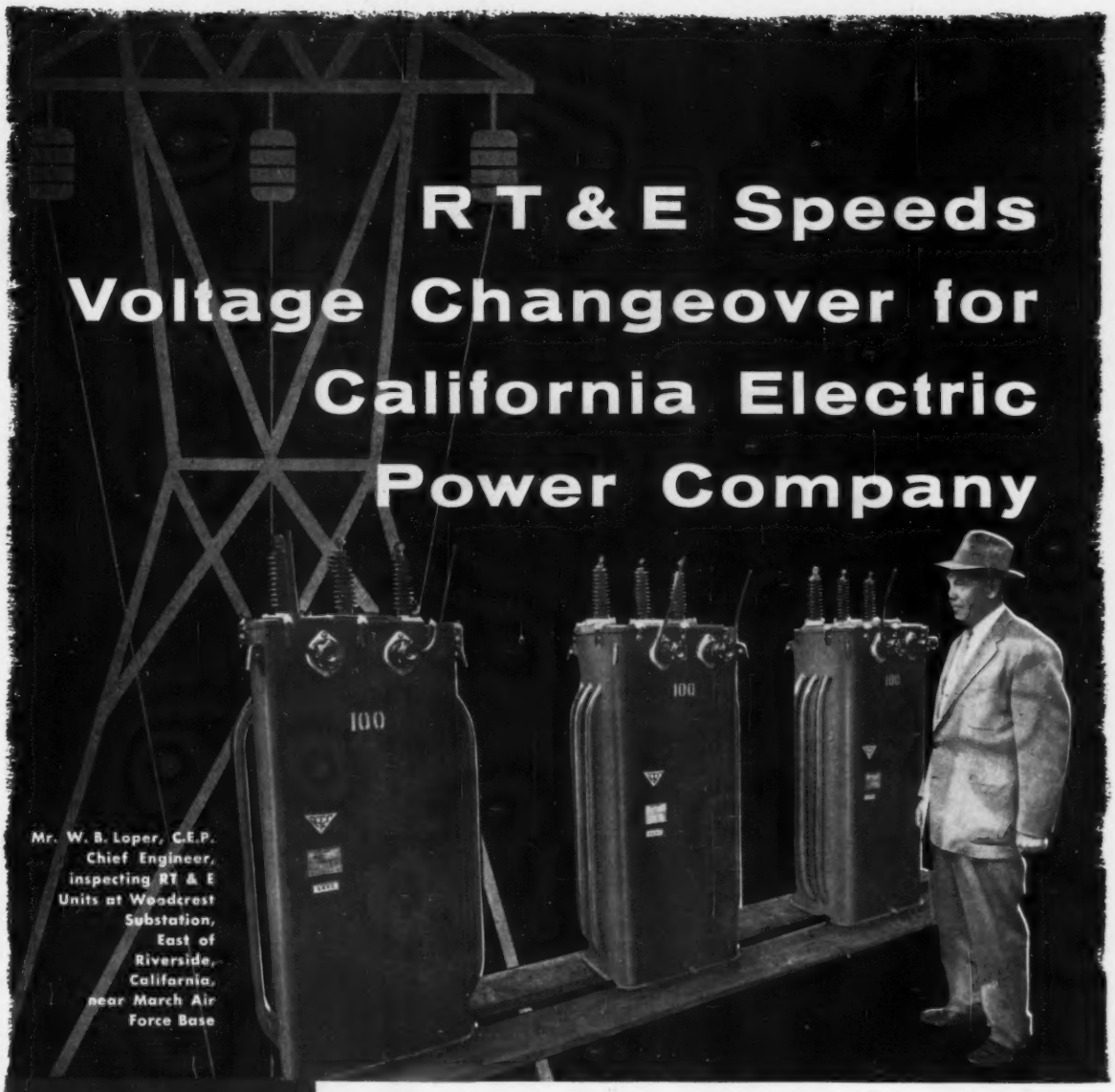
Hot dipped galvanized steel hardware is standard. Aluminum hardware available on all but Catalog #PAC-3.

AVAILABLE THROUGH ELECTRICAL WHOLESALERS EVERYWHERE

JASPER BLACKBURN CORPORATION

1525 WOODSON RD. • ST. LOUIS 14, MO. • PHONE: WYdown 3-9430

R T & E Speeds Voltage Changeover for California Electric Power Company



Mr. W. B. Loper, C.E.P. Chief Engineer, inspecting RT & E Units at Woodcrest Substation, East of Riverside, California, near March Air Force Base

IMPULSE TESTED

R T & E CORPORATION
Waukesha, Wisconsin

Equipment to help provide power for America

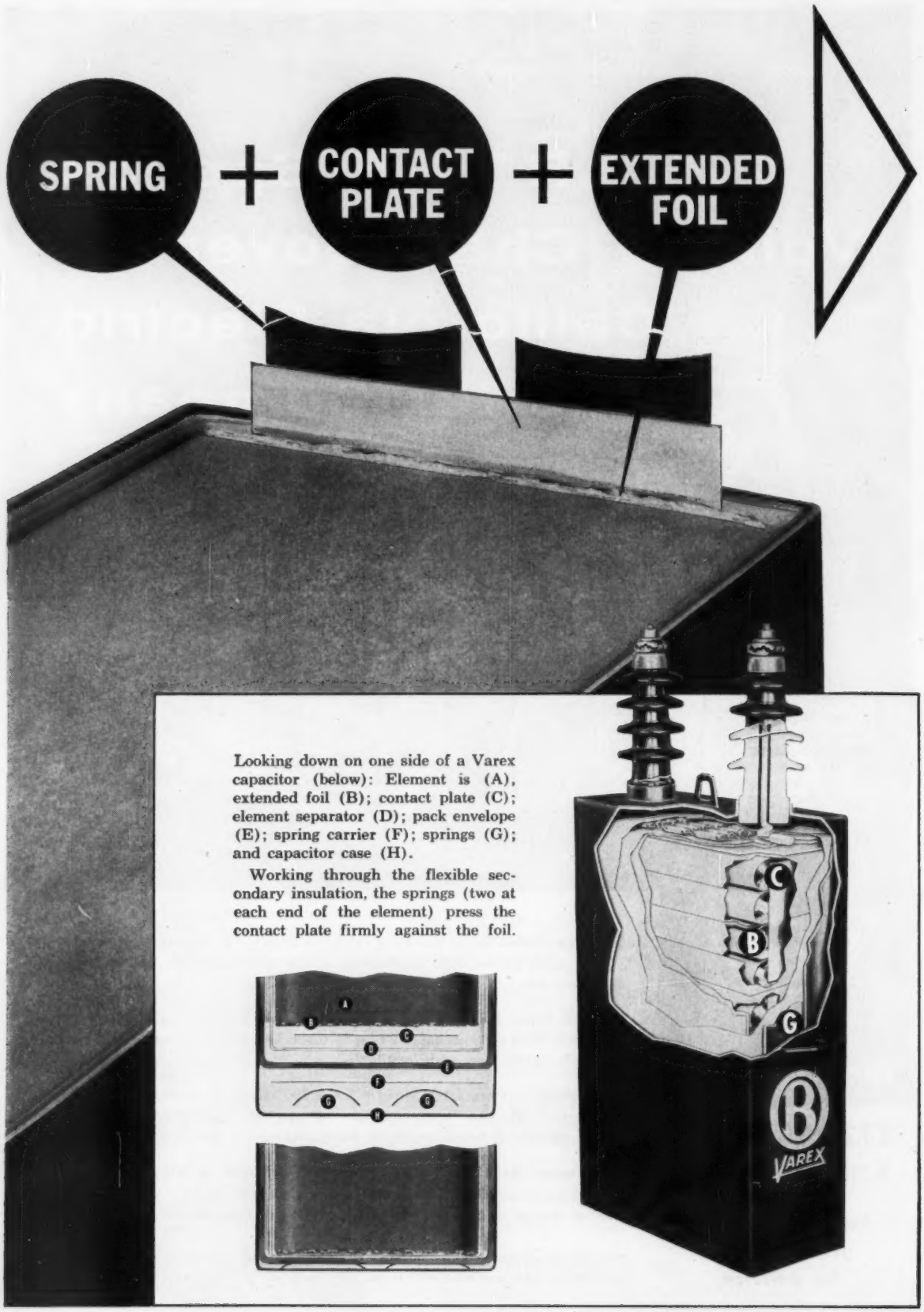
California Electric Power Company faced the problem of making a rapid cutover . . . in areas served from distribution circuits of 2400, 4160, and 4800 volts delta and wye . . . to 12,000 volts.

Mr. W. B. Loper, Chief Engineer of California Electric Power, found after careful study that these cutovers could be made faster and more economically if special 100 KVA transformers were available.

The problem was presented to the R T & E Engineering Department, where swift and careful attention to the problem resulted in a specially designed transformer capable of transforming all three voltages to the 12 KV level.

These special units were manufactured and delivered in record time to meet an emergency condition, saving the utility time and money. Electrical characteristics proved to be excellent, and cutovers were made on schedule.

This type of special service is another reason why R T & E Transformers are being specified by more and more utilities the nation over.



Looking down on one side of a Varex capacitor (below): Element is (A), extended foil (B); contact plate (C); element separator (D); pack envelope (E); spring carrier (F); springs (G); and capacitor case (H).

Working through the flexible secondary insulation, the springs (two at each end of the element) press the contact plate firmly against the foil.

ADD UP TO

Effective Electrical Contact, Lower Current Density

IN VAREX CAPACITORS

Here's the simple answer to providing an effective electrical contact where current is introduced into the capacitor element. This is the critical point in the capacitor, especially under transient voltage conditions.

An aluminum foil extends from either end of the Varex element. Against the foil goes a large contact plate that touches every turn of foil. Steel springs -- two at each end of the element -- press the plate against the foil, acting like strong, tireless hands to maintain a good contact.

Besides its mechanical simplicity, this method of contact is better able to handle electrical stresses caused by extra-heavy current flow. Since the contact areas are more numerous and larger than with other designs, there is less current flow at any one point.

Here is a contact method fully able to withstand the most severe stresses. It's available only in Varex.

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass

4878 H

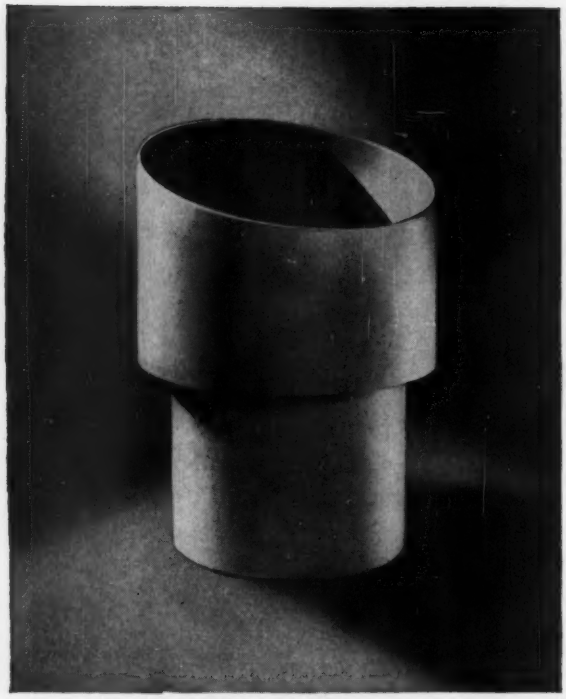
Utilities can depend on equipment containing C-D-F Insulating Parts

The reliable operation and long life of heavy electrical equipment often depends on insulating parts. A good supplier of insulation draws from past experience to make this possible—C-D-F has been a recognized industry leader since 1895! A good supplier expands his research and technical skill consistently—C-D-F offers the *widest range of electrical insulating materials*, from Vulcanized Fibre to C-D-F Products of Teflon.*

A BIG, RELIABLE SOURCE OF SUPPLY

As a buyer of Utility Electrical Equipment, you gain when your manufacturers work with C-D-F. Quality and dependability of electrical insulation, at reasonable cost, are guaranteed. The latest technical advances and ideas can flow freely between you and C-D-F's engineers. This page shows only a few of the many products C-D-F makes and fabricates for the electrical industry. Consult Sweet's Design File for catalog information, or call your C-D-F sales engineer (sales offices in principal cities)—you'll find he's a good man to know!

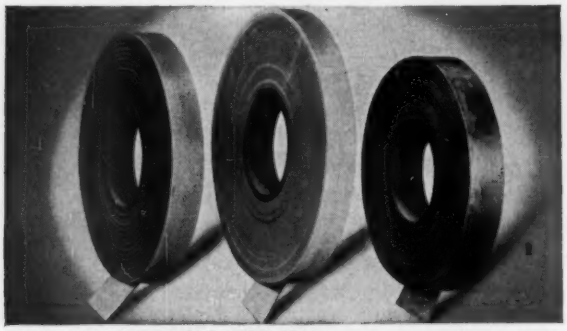
*Du Pont Trademark



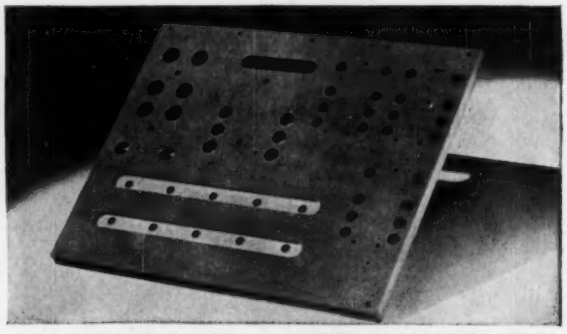
C-D-F HANDLES THE COMPLETE JOB An oil circuit breaker component is made from two Dilecto laminated plastic tubes, with a threaded ring joining the assembly. From raw materials to finish machining C-D-F does it all!

CONTINENTAL-DIAMOND FIBRE

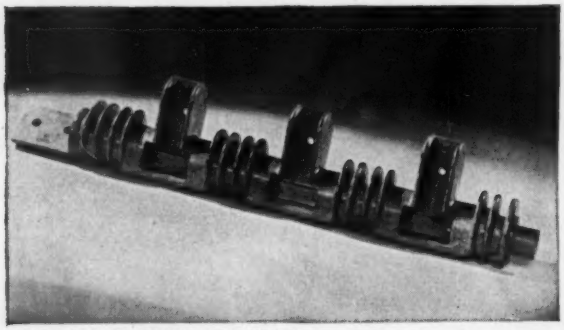
A SUBSIDIARY OF THE Bakelite COMPANY • NEWARK 15, DEL.



C-D-F MAKES FLEXIBLE INSULATION To meet critical high heat and electrical insulating needs, C-D-F makes these efficient, easy-to-apply tapes. Size range is wide, with latest resins and backing materials used. Write for samples and technical bulletins of Silicone, Teflon, and Micabond tapes.

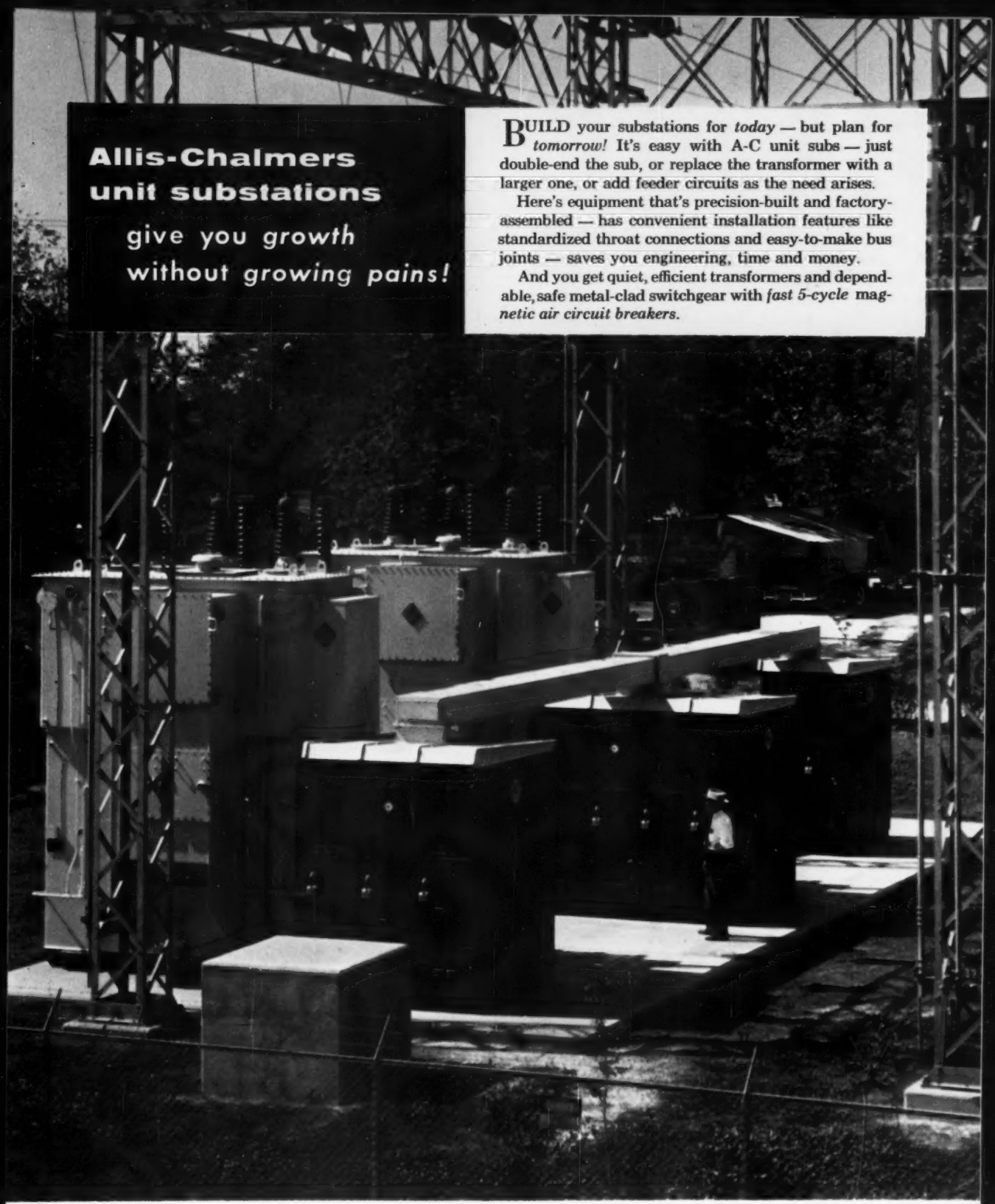


C-D-F UNDERSTANDS THE ELECTRICAL INDUSTRY'S NEEDS Precisely machined to close tolerances, Dilecto panel boards guarantee dependable insulation, help designers save space. New C-D-F Dilecto catalog is yours for the asking, lists all new grades.



C-D-F MOLDS MANY SPECIALTIES This shaft insulator for a circuit breaker is molded from C-D-F's cloth-based industrial thermosetting plastic, Celoron. Note complexity of mold, clean detailing. Celoron has high impact strength, is used in switchgear.

C-D-F GIVES YOU BETTER MOTOR AND GENERATOR INSULATION All these built-up and bonded mica products are made by C-D-F to provide uniform high-heat resistance and dielectric strength. All forms of Micabond are made for better performance and lower costs.



Allis-Chalmers unit substations

give you *growth* without *growing pains!*

BUILD your substations for *today* — but plan for *tomorrow!* It's easy with A-C unit subs — just double-end the sub, or replace the transformer with a larger one, or add feeder circuits as the need arises.

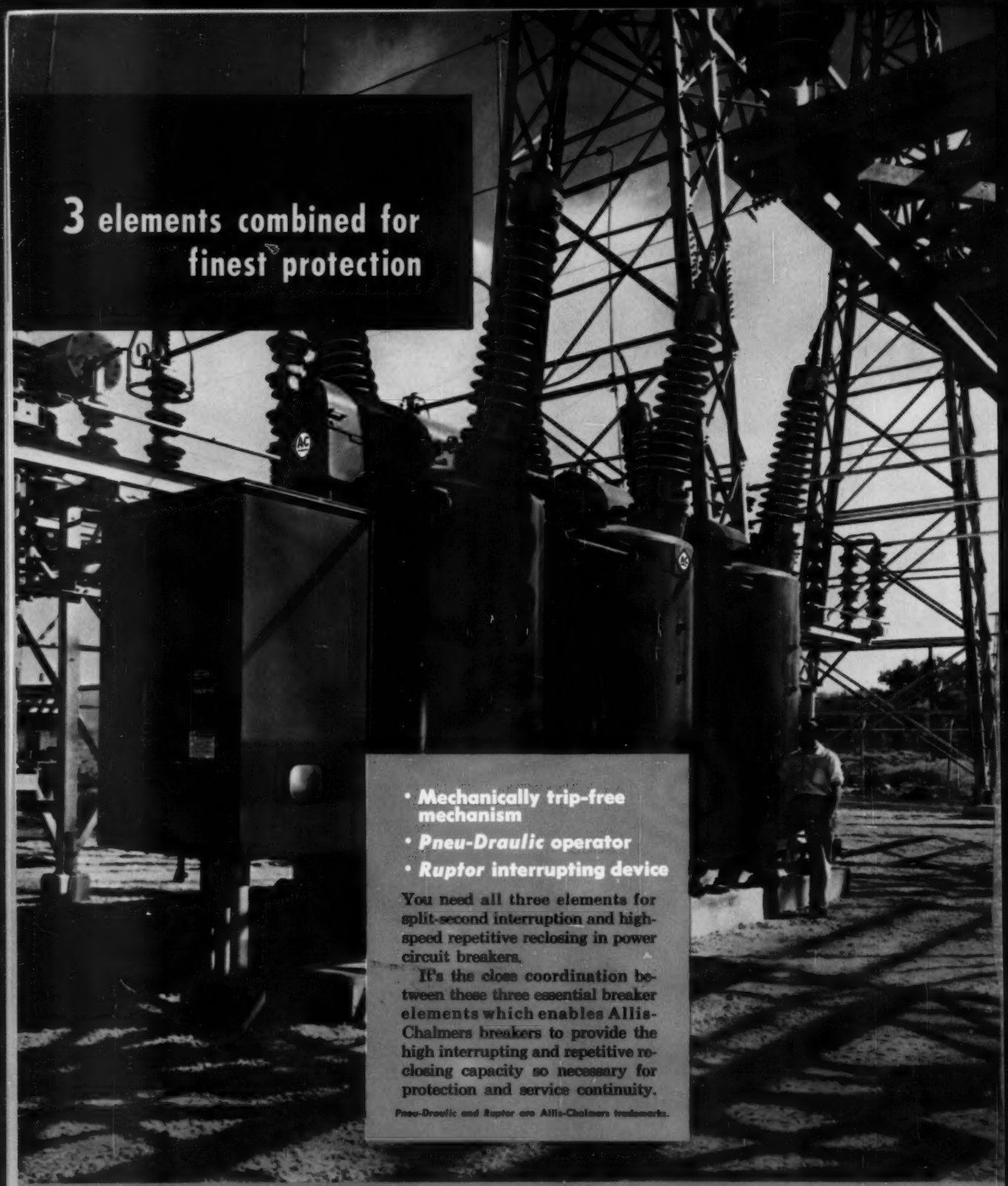
Here's equipment that's precision-built and factory-assembled — has convenient installation features like standardized throat connections and easy-to-make bus joints — saves you engineering, time and money.

And you get quiet, efficient transformers and dependable, safe metal-clad switchgear with *fast 5-cycle magnetic air circuit breakers.*

A-5245

For details regarding A-C unit substations, contact your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS *for progress in switchgear*


3 elements combined for finest protection
• Mechanically trip-free mechanism
• Pneu-Draulic operator
• Ruptor interrupting device
You need all three elements for split-second interruption and high-speed repetitive reclosing in power circuit breakers.
It's the close coordination between these three essential breaker elements which enables Allis-Chalmers breakers to provide the high interrupting and repetitive reclosing capacity so necessary for protection and service continuity.
Pneu-Draulic and Ruptor are Allis-Chalmers trademarks.

***Get more information** about these high-speed power circuit breakers. Call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.*

ALLIS-CHALMERS

A-5655

Editorial Comment

APRIL 7, 1958

$2.5 Million A Year to Push All-Electric Living

Money does not make a program, but it sure can make a program go. Approval by the Commercial Division Executive Committee of Edison Electric Institute of a "hard-hitting national industry sales promotion program to sell electricity—or the all-electric way of living— and sell it to the exclusion of any other method of living" represents a giant step forward.

Back up this program with $2,500,000 a year in national advertising and you will go a long way toward overcoming the competitive promotion advantage now enjoyed by the gas industry.

Electrical World hopes that this idea of a hard-hitting program gains the full backing of the EEI Board and is accepted by all members.

We also hope that the door will be open for contributions from all electrical manufacturers. Those who do not sell appliances have almost as much to gain as those who do.

The proposal of the Commercial Committee has tremendous possibilities. It will be most effective if the all-electric program draws all-industry support.

Sharing of Computer Programs—An Untapped Asset

Wider engineering use of digital computers depends today not so much on further perfection of the computer itself as it does on reducing the cost of preparing or "programing" problems for machine solution. The computer itself has reached a high degree of perfection. But the cost of programing a problem for solution is often substantial. For example, a program containing 4,000 machine instructions can cost $20,000 to prepare. Yet such a program would use possibly 2 or 3 hours of computer time before being superceded.

Authorities in attacking the problem recently have pointed to the possibilities of so-called programing devices that automatically translate the language of mathematics into computer code. Also suggested has been the automatic translation of programs from the code of one computer type into the language of another, thus avoiding the expense of re-programing.

But a step that can be taken immediately is the interchange of complete digital computer programs for specific power system problems common to many other utility systems. If developers of such programs were willing to share them with others, on some equitable basis, the saving in time, effort, and expense would be tremendous.

In a commendable effort to foster such an interchange, a list of 92 existing utility engineering programs has been compiled by two AIEE committees; the Computer Application Subcommittee of the Systems Engineering Committee working with the Application Subcommittee of the Digital Computer Committee. Steps are already being taken to revise and publish additions to this list periodically.

The next logical step is the development of an organized and coordinated system for the sharing of digital computer programs among electric utilities on an equitable basis that will compensate the originators of a program for their initial investment of time and effort.

Formation of such a clearing house for sharing programs remains one of the great untapped assets of machine computation today in the utility field.

Congress Restores 90-10 Ratio on

Senate-passed bill expected to clear House. Measure provides federal payment of 90% of utilities' costs for relocating on interstate system—where state laws authorize it

The new highway bill that Congress was completing just before members went home for the Easter recess would authorize federal money for utility relocation costs in those states having laws that permit the practice.

The measure must be classed as a big victory for utilities. It won't be a clear-cut one, though, if opponents of government-aided relocation block the payments in the courts.

Action Expected Before Recess

Federal highway funds will pay 90% of the cost of utility relocations on interstate system projects—in states with laws authorizing reimbursement of the utilities by the state highway departments.

The Senate-approved bill went to conference April 1 with the House, where it was slated for final passage before the ten-day Easter recess.

A floor vote in the Senate the previous week had restored the 90% federal reimbursement provision of the 1956 Highway Act. The 47-38 roll-call vote eliminated from the bill Senate committee language that would have reduced the federal portion to 70%. This committee proposal would have upped a state's share to 30% and made the states even more reluctant to adopt legislation for full reimbursement of utility relocation costs by highway departments.

So far, 16 states have enacted laws providing for repayment on interstate projects. Under the 1956 act, 90-10 federal-state matching funds pay the entire construction expense on these projects, including relocation costs where state laws provide for it. Of the 16 states, ten reimburse the cost of utility relocations on interstate projects only.

Six States Cover All Federal Aid

Six of the states with reimbursement laws on the books extend the repayment arrangement to cover all federal-aid highway construction, including federally assisted non-interstate projects where 50-50 matching applies.

One of the six, Connecticut, makes repayment to utilities for all relocations on the state trunk system, even if the project happens to be a 100% state responsibility. In this case, of course, the federal government wouldn't pay.

Only two states, Illinois and Massachusetts, have repayment provisions that are merely permissive. Laws of the other 14 make reimbursement mandatory.

Five State Bills Vetoed

Vetoes by state governors have blocked reimbursement bills that passed the legislatures in five states —Colorado, Kansas, New York (where a new measure is pending), Pennsylvania, and Wyoming. Utilities are expected to continue a hard drive to obtain legislation in these states and in the other 27 which have no reimbursement laws.

Federal sharing of reimbursement costs has been accepted practice of the Bureau of Public Roads for a number of years in states with laws requiring repayment of utilities. Until 1956, of course, limited federal contributions applied only to traditional 50-50 federal-aid construction.

The 1956 law broadened the area of federal responsibility by directing the bureau to compensate any state that shall pay utility relocation costs. This language remains undisturbed as a result of the recent Senate floor

These Are the States With Laws Authorizing Payment of Utility Relocation Costs

State	Classes of Highways Involved	Cost Legislation
Connecticut	Any state trunk highway	Mandatory
Delaware	Interstate system only	Mandatory
Florida	Interstate system only	Mandatory
Idaho	All federal aid systems	Mandatory
Illinois	Interstate system only	Permissive
Maine	Interstate system only	Mandatory
Massachusetts	All federal aid systems	Permissive
Minnesota	Interstate system only	Mandatory
Montana	All federal aid systems	Mandatory
Nebraska	Interstate system only	Mandatory
New Mexico	All federal aid systems	Mandatory
North Dakota	Interstate system only	Mandatory
Oklahoma	Interstate system only	Mandatory
Tennessee	Interstate system only	Mandatory
Texas	Interstate system only	Mandatory
Utah	All federal aid systems	Mandatory
Legislation Pending		
New York*	All federal aid systems	Mandatory
Virginia	Interstate system only and only in towns and cities	Mandatory
Mississippi	Interstate system only	Mandatory

Source: Bureau of Public Roads; National Highway Users Conference
* Gov Harriman vetoed a similar bill last year

action. It applies both to 90-10 interstate and regular 50-50 construction.

The Senate version of the bill would authorize spending about $5.5 billion for highways in the next two fiscal years.

An amendment on federal fund availability adds a stipulation that "reimbursement shall be made only after evidence satisfactory to him shall have been presented to the Secretary (of Commerce) substantiating the fact that the state has paid such cost from its own funds."

So far, the Secretary of Commerce has not released a dime to compensate the states for reimbursements due or paid out under state laws for interstate projects since July 1, 1956. The Administration opposes reimbursement of utilities and questions the validity of many state laws applying to interstate construction.

As examples, Georgia's original reimbursement law was declared unconstitutional, and test cases have gone through the trial stage in New Mexico and Tennessee. However, the legislatures of other states such as Maine and New Hampshire took the precaution of getting advisory judicial opinions before they passed their reimbursement laws.

8% Gain in Sales Expected By Electric Utilities in '58

Electric utilities expect to increase sales in 1958 by 8% over 1957, a breakdown of the government's 1958 business expectations survey reveals. The information is contained in a report on the joint Commerce Department-Securities & Exchange Commission study on capital plant and equipment.

The overall public utility category predicts a sales rise of 9%. Gas companies anticipate a gain of 12%. Sales in manufacturing are expected to be down 2% from 1957 volume.

Business Begins the Climb Back

Relocations

Regional reports point up some optimism in Southeast, Ohio, Northwest, and Southwest, but the return trip is slow

The U. S. economic climate appeared as varied as the weather of recent weeks. Based on reports of McGraw-Hill news bureaus, regional conditions hold the paradox of some boom amid the gloom.

In the Southwest, for example, an upturn in construction, a favorable farm outlook and a high level of bank deposits were contrasted by sagging employment, lagging retail sales, and an ailing oil industry.

A sizable spurt in home building is helping the construction industry. The farm and ranch outlook is the best in years despite delays caused by cold, wet weather. Sales of tractors and farm equipment are up.

There are more points of strength than weakness in the Southwest's business outlook, according to Dr Charles Walker, Dallas Federal Reserve Bank's economist-advisor. He cites lower interest rates and availability of money, steady rise in state and local government spending, and increased federal outlay for defense.

Unemployment in Texas has gained but still remains below the U. S. average. Cutbacks in oil and gas, manufacturing and mining activity are factors in a low point for Oklahoma's industrial employment.

Oklahoma Gov Raymond Gary has set a goal of $100 million in contracts to be let this fiscal year, with $30 million in highway projects requested for April, May and June.

Texas Gov Price Daniel has reactivated a commission to step up efforts to attract new industry.

Ohio: Rise in Construction

The outlook for new construction is a bright spot in Ohio. In January contracts awarded for future construction amounted to $124.7 million, an advance of 38% over January, 1957. Contracts for nonresidential building were up 19%, residential building, 1% and heavy engineering projects also were up.

Cleveland's February building permits set a five-year record for the month with a 25% gain over average of the last four years.

There were signs too that the soaring unemployment curve was leveling off. Unemployment compensation rolls listed 206,000 Ohioans early in March. This was a weekly increase of 1,000 compared with previous weekly jumps of 10,000 in February. But the weekly claim loads for unemployment pay still remained at the highest level since 1939.

Steelmaking rate in Cincinnati slipped to 29% of rated capacity early last month. In Cleveland it was 34% and in Youngstown, 53%.

Also down were railroad freight car loadings and operations of metalworking industries.

Northwest: Low Point Passed

The worst is over, but improvement probably will be slow. This appears to be the consensus in the Pacific Northwest of current business conditions.

The low point apparently was reached in late February when the price index grade of plywood dropped to $64, lower than anyone had thought possible a few months ago. The $64 dip acted as a shocker; mill after mill laid off crews to lower inventories. Market-wise purchasing agents quickly took advantage of the low price, with the result that prices bounced back up $4 to $8 by early March.

Lumber has not yet turned but prices appear to have stabilized. There are some signs that the hoped-for upturn in housing starts is underway. Dwelling permits in 64 major Northwest cities totaled 507 in February compared with 430 in the same month last year.

Spokane, Wash., and Eugene and Portland, Ore., had increases in department and apparel store sales. Seattle real estate sales totaled $50 million for the first two months compared with $46.8 million for the period last year.

The percentage of unemployment among workers covered by insurance stood at 10.8% as of March 8.

Washington's state director of

commerce and economic development, Dewayne Kreager, believes that the level of the state's economy "if anything, will be a little lower" than that of the nation as a whole. He foresees slight improvement in the summer and a slight dip in the first quarter of '59.

Southeast: Diversified Optimism

With only spotty exceptions, the Southeast's economy is in a healthy state. Business leaders there are confident coming months will reflect a continuing prosperity.

This situation is something new in the history of the region. Only once before—in 1954—has the Southeast found itself better off economically in relation to the nation during a business readjustment. Historically, the section has been the first to feel an economic decline and the last to benefit from an upturn.

Today, though, diversification keynotes the optimism of business leaders. Twenty-five years ago, two out of every five Southern workers depended on farming for a living. Manufacturing consisted primarily of textile and lumber industries. Although farm income from crops declined sharply last year, and fewer persons were on lumber and textile payrolls, personal income in the Southeast in 1957 was higher than any previous year.

Department of Commerce figures chart the effect of diversification. Increase in value added by the manufacture of goods produced during post-war years is a case in point. The rise for the U. S. was 57%. But in Birmingham, Ala., it was 108%; in Jacksonville, 70%; Miami, 181%; Atlanta, 65%; Charlotte, 75%; and in Columbia, S. C., 93%.

Unseasonably cold weather has been a drag on retail sales but plans for increased promotions indicate a healthy spring record.

EEI Plans Office Change

Edison Electric Institute's general office will have a new address after April 25. The trade association will then move to 750 Third Ave, New York 17, N. Y., and occupy the 16th floor of a building between 46th and 47th Sts. The move is the first for the Institute since it was organized in 1933.

Atomic Progress

A-Plants to Carry More Load By '65, Says Pacific G&E VP

Walter Dreyer predicts that much of the company's new thermal capacity installed after 1965 will be nuclear

Pacific Gas & Electric Co probably will have one or more large nuclear plants in service by 1965, according to Walter Dreyer, vice president and chief engineer.

Dreyer said, "It is my personal opinion that much of the new thermal capacity thereafter will be nuclear." As this develops, conventional thermal plants will then carry peak loads. Nuclear power will play an increasingly important role in PG&E's base load within eight years, he said.

Dreyer made his prediction at a recent Vallectitos, Calif., seminar on economic potential of A-power, which was sponsored by PG&E and General Electric Co.

How soon the changeover will come depends on how fast the capital costs of such plants are reduced, the rate of progress in development and utilization of nuclear fuels, and availability and price of fossil fuels, he said.

PG&E expects its projected 60-Mw nuclear plant at Eureka to break even with an oil-fired plant with oil at $3 bbl. Dreyer said PG&E's studies on a larger nuclear plant indicate unit capital costs will have to be cut to $270 per kw to be competitive with the most efficient conventional steam plants.

The company is going ahead with studies on a 200-Mw nuclear plant. To compete with new units going in at its Pittsburg steam plant, the atomic station would have to generate power for 6.5 mills per kwhr.

Dreyer forecast that thermal plants in PG&E's system would be supplying about 50 billion kwhr by 1975. If they were oil-fired, they would use 220,000 bpd. "Even if gas could provide half the fuel," he said, "the steam plant would consume the content of a 100,000-bbl tanker each day."

The spokesman gave this estimate of PG&E's future demands: 1961, 30 billion kwhr, with hydro supplying 13 billion and thermal 17 billion; 1970, 55 billion kwhr; 1975, 77 billion kwhr.

Steam plants will play an increasing role in meeting the company's demand—in 1945, hydro capacity was 2.2 times steam capacity, in 1952 the two became equal, and in 1961 steam will be 1.5 times hydro.

NUCLEAR NOTES

Power companies may get first crack at building reactor plants along lines of two design studies presented to AEC last week by General Electric and Kaiser Engineers. AEC Chairman Strauss is expected to hold out for private construction. GE's reactor design is for a power and plutonium producing facility costing between $100 and $200 million. Kaiser's is for a $45 to $75-million gas-cooled, graphite-moderated reactor. Strauss' fight will be an uphill battle since Joint Committee on Atomic Energy is pushing for federal construction of the reactors at AEC installations.

Rep Wayne Aspinall (D-Colo.) succeeds late Rep John Dempsey (D-N.M.) as a member of Joint Committee on Atomic Energy. Like Dempsey, the 62-yr old Aspinall is expected to be interested in matters on uranium mining and milling in the Rocky Mountains.

Architect Maynard and engineer Haines...

show that good industrial lighting, . . .

'Live' Power-Up Show Premieres in St. Louis

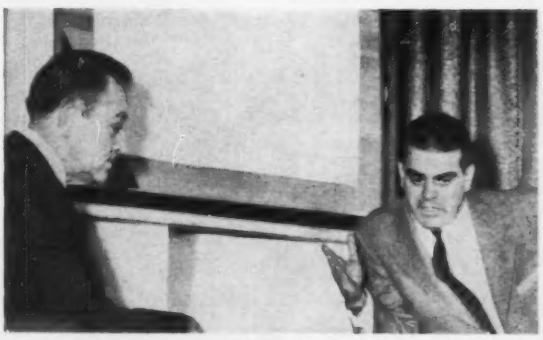
Get more production at lower costs, improve your competition position, and tack an extra hour of production onto your 12-hour clock through proper electrification of your productive facilities. These were the recurrent themes of the Westinghouse "Power-Up" skit that made its premiere performance at the Chase Hotel in St. Louis recently.

Co-sponsored by Westinghouse, Union Electric Co, and Illinois Power Co, the show had a turnout of 865, more than half those invited. The audience was composed of management and other influential personnel in industries with loads of 150 kw or more, consulting engineers, architects, and electrical contractors. The show and the dinner which preceded it were presented without charge to those invited.

Put on by professional actors, the show used a revolving stage to keep the action moving along. The story relates the efforts of two partners in an architectural and engineering firm to convince an industrial customer, the Hattigan Corp, that quality lighting, distribution, and electrical equipment in their plant modernization is the most economical in the long run, even though the costs run 20% over the preliminary estimates. Despite pressure from Hattigan and cost accountant J. P. Nizely to cut corners and use cheaper methods and materials, engineer Ed Haines holds out for a first rate distribution system. Architect Mackenzie Maynard goes down the line for modern lighting and top quality motors. Moral and logical support comes from the ghosts of the two men's fathers, who founded the firm. When the partners show signs of weakening under a take-it-or-leave alternative from Hattigan, their secretary Miss Miller forces them to tackle the Hattigan planning committee in person by threatening to quit if they desert their fathers' standards.

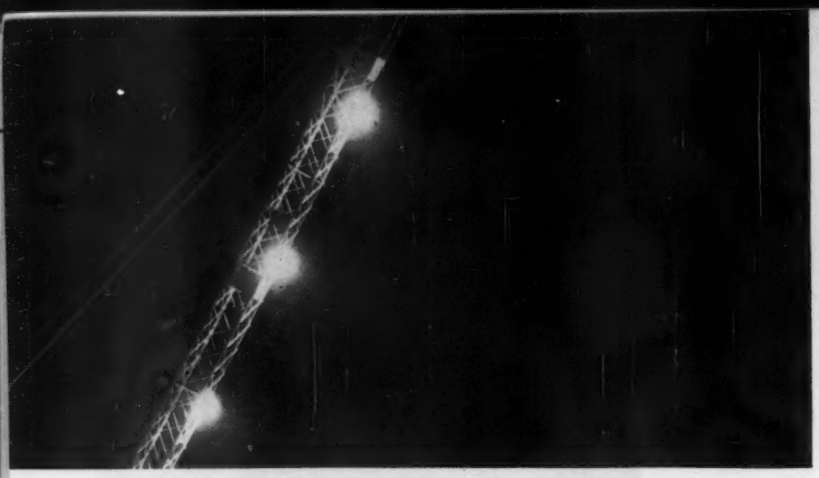
In the final scenes, Maynard and Haines sell the committee on a modern Power-Up modernization by pointing out that they will get the equivalent of a 13-hour clock, an extra production hour to better meet competition. The Power-Up Show is now being used by numerous other utilities.

. . . automated production . . .



. . . and top quality products . . .

. . . add extra hour to production clock



Progress, Partnership, and Politics

Another noisy political clash over the middle Snake River seems imminent after Pacific Northwest Power Co filed for permission to build a high Mountain Sheep dam last week.

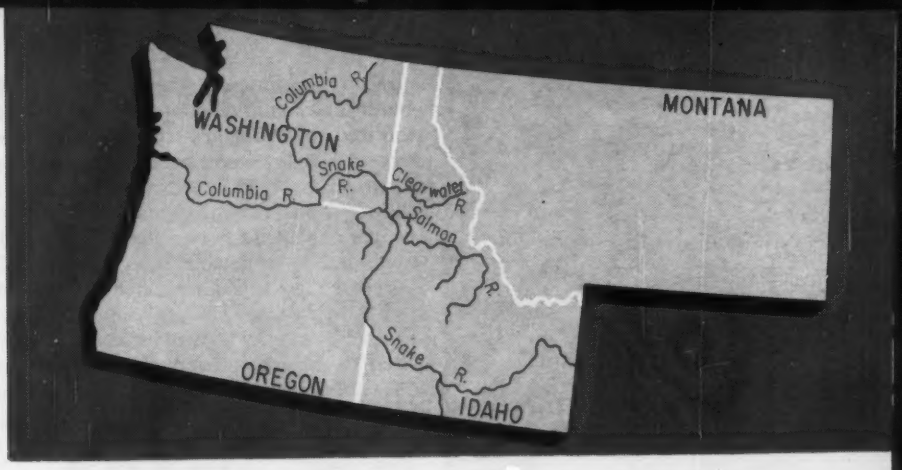
Farther upstream, the rumbling of heavy construction equipment reverberates through the Snake's rocky gorges as Idaho Power Co rushes to bring Brownlee Dam's 360-Mw initial capacity into service before year's end.

And there are other rumblings in the Pacific Northwest. Although there's no power shortage for the time being, Northwest power men haven't stopped worrying about how they can build capacity fast enough to keep up with expected loads in the '60's.

They are concerned, too, with such controversial subjects as Oregon's revolutionary initiative measure; the perennial fish-vs-dam problem; the real meaning and progress of "partnership" in the area; and a proposed regional corporation which would replace BPA.

Quietly, in the background, the Pacific Northwest's local brand of "partnership" is making progress. But some utility men feel that "partnership," in the sense of private financing of reimbursable features of the hydro developments, has not yet shown itself in the Northwest.

The upsurging growth of electrochemical industry fostered by large cheap power blocks has slackened, but area growth looks good for the



Today in the Pacific Northwest

long term. Aluminum is diminishing as the big growth factor, probably to be supplanted by gains in commercial and residential load.

The big question is which facilities will be developed to meet predicted load growth.

Pacific Northwest Power Co's latest application to the Federal Power Commission is for a 670-ft high, 1,520-Mw dam to be built just upstream of the confluence of the Snake and Salmon Rivers. The site is three miles below the original Mountain Sheep location, and about 50 miles south of Lewiston, Idaho.

High Mountain Sheep would be the highest arch-type dam in the country, 120 ft higher than Grand Coulee. It would form a reservoir 58 miles long, extending to Hells Canyon.

Preliminary cost estimates are in the neighborhood of $245 million. The company predicts it could be producing power in four years, and spokesmen emphasized that the project could get underway at a time when construction workers are in need of employment.

The new application came only two months after the power commission rejected the Northwest group's application to build two low dams at Mountain Sheep and Pleasant Valley, and less than a week after FPC turned down a bid for a rehearing.

The commission has recommended instead a high dam at Nez Perce, a site that has for years been opposed by investor-owned utilities and western fish and conservation groups.

Preliminary data submitted with the application will be supplemented by further studies of Snake River power and flood control potentials, the company said, "so that the commission may determine what project or combination of projects is, in view of all costs and benefits, best adapted to a comprehensive development of the resources involved."

But the biggest difference among the combinations is the effect each might have on the Northwest's fish. Today over 250,000 adult salmon and steelhead trout find their way up the Columbia to the Snake River. Some take to the Clearwater and the Imnaha, most take the Salmon River. The remaining few continue up the Snake to Brownlee, where they must be trapped and lifted by truck, since the dam will be too high for fish ladders.

Salmon River Still Open

Fish people, while they do not like any of the dams on the Snake, prefer the proposed high Mountain Sheep to Nez Perce. Although the Mountain Sheep dam would block the Imnaha, it would leave the more important Salmon River open to fish migration.

But the FPC's Nez Perce Dam is the worst that could happen to the fish, for it would block forever the Salmon as well as the Imnaha and upper Snake to spawning salmon unless successful and less costly means are found to get fish over high dams.

But the Snake has no corner on controversy.

The City of Seattle faces a fight from mining groups on its 540-Mw Boundary project, and Tacoma is meeting opposition from fish people on its 450-Mw Cowlitz River development.

One authority had this to say on Northwest hydro development:

"We need every watt of power private industry and public power can develop, and it's time we forget the old fight between public and private power and get the job done. Politicians who use the old feud to win votes deserve to be defeated."

Meanwhile, back at the statehouse, political drums are beginning to roll again. Oregon's Democratic Gov Robert D. Holmes is apparently backing an initiative measure that could put the state into the power business lock, stock, and barrel.

The initiative would set up a three-man Oregon Power Development Commission with unlimited authority to issue revenue bonds. The commission could condemn private utilities and operate their facilities, pending eventual transfer to such agencies as PUD's, co-ops, and municipals.

Sponsors of this measure indicate their intent is to put Oregon

NEUBERGER: His Columbia Basin Corporation bill gets a hearing

on a competitive basis with the state of Washington under priority and preference provisions in federal law.

Washington, with a big percentage of "public" power agencies, sits higher on the preference totem pole than Oregon, where power companies serve 85% of the customers. The PDC measure would boost Oregon's preference position.

It would, said Gov Holmes, "give the state at least an agency to buy blocks of power—if some is available—to sell to industry."

Beyond that, he said, is the possibility that the state could file on a site and develop its own hydro.

"But whether we do produce power or not," said the governor, "the major purpose would be to qualify under the preference clause. It's a better answer to put ourselves in a position where we can qualify than to hope for some changes in the preference clause."

Gov Holmes will be a candidate for reelection on the same ballot as the PDC initiative.

Also on the ballot in November will be an amendment to the state constitution which would remove the authority of the proposed power commission to go into the retail power business, but would allow it to sell directly to heavy industry with loads of 10,000 kw or more.

Sponsors of the initiative say the constitutional amendment is too restrictive, and brand it a "private power" measure.

What are the chances for the State Power Development Commission? Historically, they are not good. The commission has been authorized by Oregon's constitution since 1932, but implementing legislation has been voted down repeatedly. Said one utility man: "The people of Oregon have voted down more public ownership in the last 20 years than any other state."

But with Gov Holmes' implied backing, and with the increasing strength and adeptness of the AFL-CIO political organization, it shapes up as a hot contest. The pitch will be: "More Power, More Industry, More Jobs."

But the question remains: Where will power to serve customers in both states come from if Oregon does go on a "preference" status?

Based on firm loads in a critical year, said Dr. William A. Pearl, Bonneville administrator, there is enough power to take care of preference customers through 1965-66, but this would be accomplished by pulling federal power back from the power companies. If there is still not enough to go around, public agencies would each receive the same amount they received in the preceding year.

On Capitol Hill, Sen Richard L. Neuberger (D-Ore.) has introduced for the purpose of hearings a bill to set up a regional Columbia Basin Corporation to take over transmission responsibilities of BPA and finance new dams with revenue bonds plus federal appropriations.

Would Take Over BPA

The corporation's five-man board of directors would take over BPA within six months of organization, but it could not take over any existing federal hydro-electric project for five years. The Secretary of the Treasury would be required to accept the bonds of the corporation.

As for the present, progress in "partnership" is being made. Thomas Delzell, board chairman and chief executive officer, Portland General Electric Co, recently said:

"One of the largest non-federal construction programs in the U. S. is going on right now in the Pacific Northwest. Our power supply picture is really pretty healthy, for at least six years. And that's about par for the course in advance planning."

He cites Grant County PUD's 788-Mw Priest Rapids project, and Chelan PUD's Rocky Reach (711 Mw) as two outstanding examples of local partnership in which financing by PUD's was made possible by 50-year contracts with public agencies and power companies.

On the other hand, except for the partnership proposal on John Day Dam, there has been no other federal-local partnership proposed. Portland GE had $300 million financing lined up for John Day, but, said Delzell sadly, "It never got off the ground."

John Day Is Moved Up

New money in President Eisenhower's emergency rivers and harbors budget prompted the Corps of Engineers to announce that power from John Day might come by late 1966—if subsequent appropriations are adequate. Previous estimate of the Corps was first power in 1969.

Meanwhile, other power companies and public agencies in the Northwest have several major hydro projects underway or licensed—totaling over 4,400 Mw by 1961.

A better word for "partnership" in the Northwest would be "cooperation." Said one utility man:

"The Northwest Power Pool is partnership, and antedates the use of the word. The power pool has flourished through thick and thin because the mutual benefits of integrated operation are so great no one can afford to operate on any other basis."

The Puget Sound Utilities Council is an example of this type of partnership. Here one power company, two municipals, and two PUD's combined to bring new power supplies into their area. By interchange of surplus power, they saved some $500,000 in recent months—in water that otherwise might have been wasted.

Despite the pooling of hydro resources the Northwest may go through a period of dependence upon steam plants. Jack Stevens, consulting engineer for Puget Sound Utilities Council, feels that, if the dam builders cannot reach an agreement with the fish interest, steam plants are not far away.

Regardless of steam development, however, it appears that hydro power will be the mainstay of Pacific Northwest power supply for a long time.

An Electrical World Feature

Distribution for Shopping Centers

FRANCIS J. KOVALCIK, Middle Eastern Editor

The exodus of city people to the suburbs is a trend which will continue for some time. This movement, along with inaction by many cities over the problems of vehicular-congestion and inadequate parking in downtown areas, will support the development of suburban shopping centers. This development shows signs of continuing at a steady but lower rate than in recent years. Thus, distribution engineers need to keep abreast of those plans and practices which provide the most reliable and economic service to this important load.

In recognition of this need, a symposium on distribution for shopping centers was held during the Fall General Meeting of the American Institute of Electrical Engineers in Chicago. Four authors brought their planning experience to bear on problems arising from service to shopping centers of all sizes. This experience is presented on the following pages as a special report to the industry.

Highlights of this combined experience are:

1. Conventional overhead systems are satisfactory for most small and medium-sized shopping centers.

2. Underground primary and secondary systems are used when layout makes overhead impractical.

3. Permanent easements are obtained for all underground facilities and for some overhead lines on shopping center property.

4. Two or more primary feeds are provided for the larger and some smaller shopping centers. In some cases, the second feed is classed as alternate.

5. Most centers are fed from separate primary feeders which do not serve the surrounding residential area.

6. Large stores and large unit loads are served at primary voltage or at 277/480 v or 480 v, with smaller stores in the same shopping center served at 120/208 v, in most instances.

7. Spot networks offer 277/480-v or 120/208-v secondary service to all loads in two of the largest shopping centers.

8. All utilities indicate that prior planning with shopping center developers pays off.

Contents:

Commonwealth Edison Varies Supply Schemes....p 70

Detroit Edison Uses Three Methods.....p 73

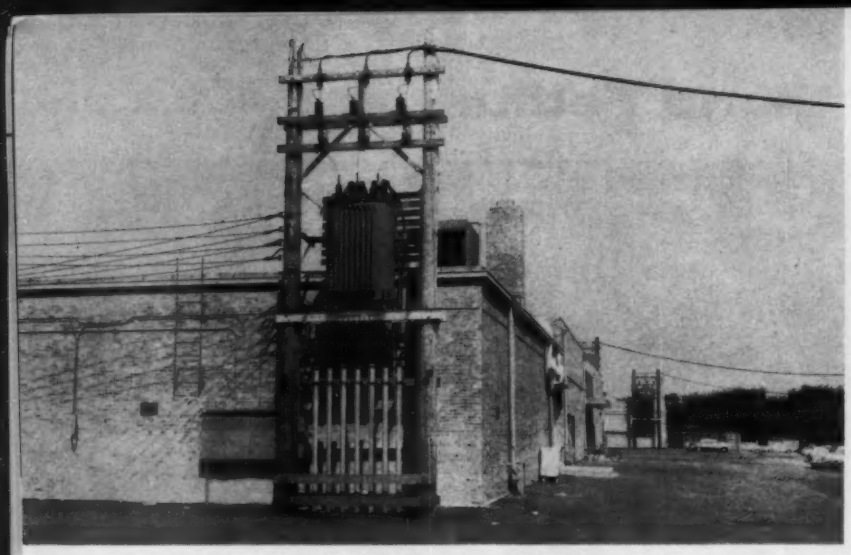
VEPCo Prefers Overhead Service.....p 75

LILCo Serves 12,000-Kva Load Underground.....p 77

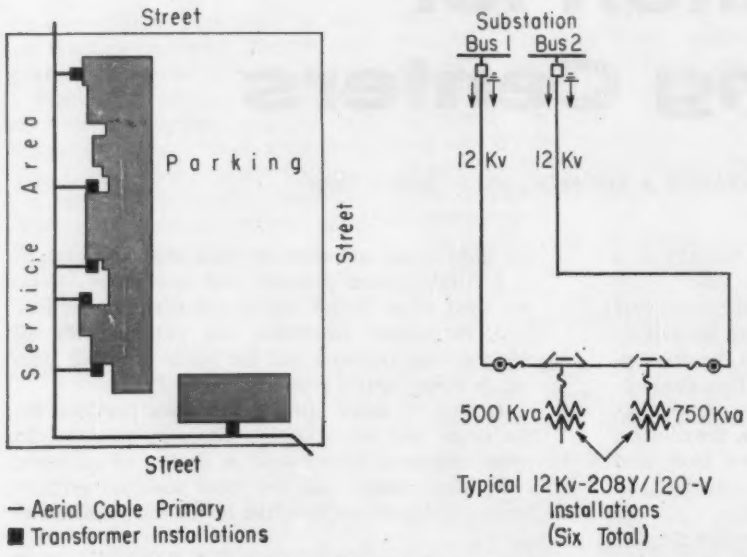
Chicago

Primary voltages of 4, 12 or 34.5 kv are used to serve large shopping centers. Primary service is aerial cable or underground

W. R. ZIMMERMAN, Commonwealth Edison Co, Maywood, Ill.

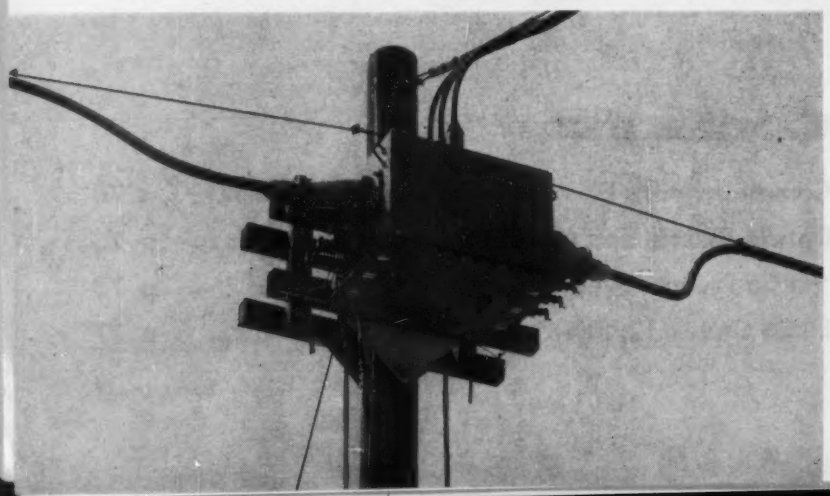


TRANSFORMERS ARE SPACED to allow use of 500 and 750-kva units, to provide for future growth, and to limit voltage drop on standard-size service drops



CERMAK PLAZA SHOPPING CENTER is served by two 12-kv lines which are fed from separate buses at the same substation. Total demand is about 2,500 kw

SELECTOR SWITCH at each transformer tap into Cermak Plaza shopping center allows for transfer or bypass of tap and sectionalizing or grounding of line



Large shopping centers pose unique problems in distribution system design and construction. In serving such installations, Commonwealth Edison Co chooses a supply voltage from among the distribution and subtransmission voltages—4, 12, or 34.5 kv—which are standard on the system. Secondary voltages most frequently applicable are 120/208 v, 277/480 v, or 480 v. Smaller stores in the center are supplied at 120/208 v; the higher voltages feed loads of 600 kw or more. Three installations will illustrate some of the problems and the solutions applied.

Cermak Plaza Shopping Center has a demand of about 2,500 kw. The buildings face the parking lot in straight lines around the perimeter, a layout to which overhead construction is applicable. Overhead, including transformers, was installed along the wide service area in the rear.

The contiguous residential area is served from a 4-kv primary network, supplied by a radial 12-kv subtransmission. With limited spare capacity in the 4-kv system and only minor line extensions required in the subtransmission, it was decided to serve the shopping center from the 12-kv system. Two 12-kv lines brought into the property at opposite corners, forming an open loop, are supplied from different buses at a large 69-12-kv substation.

Lines are protected by directional overcurrent relays for phase and ground faults. Power fuses were installed where each line enters the shopping center area and at transformer structures. Relays and fuses operate selectively to isolate faults; service is restored on unfaulted sections of either line by manual operation of 12-kv primary selector

Varies Supply Schemes for Large Loads

switches. Aerial cable was used to gain operating and cost experience with this type of installation.

Three-phase transformers providing 120/208-v service to various stores are on two-pole platforms along rear building walls. Transformers were spaced to permit use of 500 and 750-kva sizes with some provision for future growth, and to stay within voltage drop limitations on standard size conductors in service connections. At each transformer tap a multi-purpose, pole-mounted selector switch allows for transfer or bypass of the tap, and sectionalizing or grounding of the line. Stores are metered individually. All lines and equipment are owned by the utility and were installed on easements granted by the shopping center developers.

Underground Taps 34.5-Kv Line

Distribution at Hillside Shopping Center is underground through cables from an adjacent overhead 34.5-kv line. If the center were supplied from a 4-kv primary network serving the area, an additional distribution center would have been required to provide sufficient capacity on the network. Demand at the shopping center is about 4,000 kw.

Because the 34.5-kv line ties two large substations, system operating requirements do not permit splitting it into two radial lines. A normally-closed line-sectionalizing circuit breaker was installed in the line; two feeds to the shopping center were tapped to the line, one on each side of the breaker.

The line sectionalizing center consists of a two-bay steel structure to accommodate overhead line terminations, circuit breaker and associated relays and equipment. The design permits expansion to a multi-line switching center.

Because of the layout of buildings, interior mall, parking space, and loading docks, neither ground-type or overhead transformer installations were practical. Heavy conductor sizes required for secondary cables and services, coupled with problems of congestion, indicated that secondaries also should be underground. Therefore, all distribution facilities on shopping center property are underground, with facilities owned by Commonwealth Edison on easements granted by the shopping center developers.

The 34.5kv—277/480-v transformers in vaults are fed by 34.5-kv cables from the sectionalizing center. Spot network design features the feeding of a common secondary bus through network protectors to provide service continuity should either a line or transformer fail. All stores are individually metered, with facilities grouped throughout the building area.

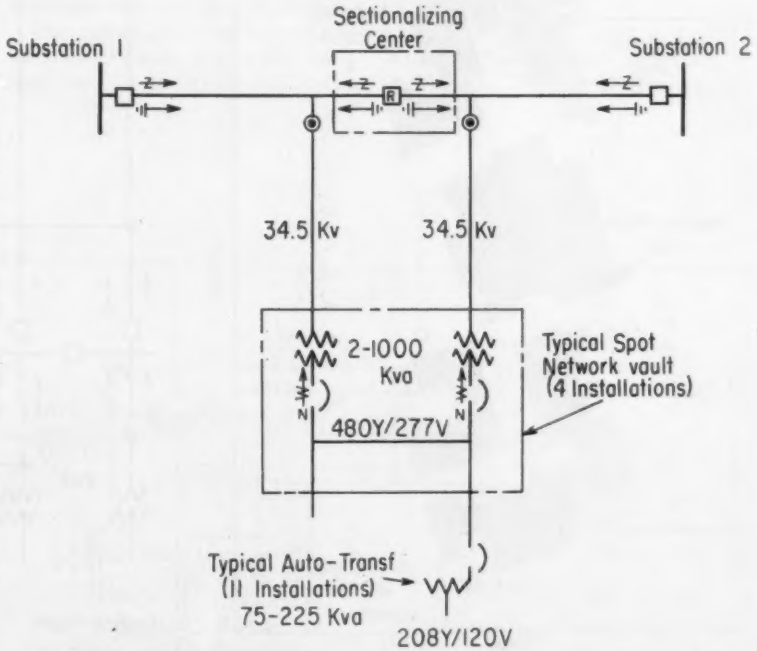
Large concentrated loads, served at 277/480 v, are in two department stores at either end of the main building and at the central heating plant. Smaller loads in intervening stores and other buildings are served at 120/208 v.

The 277/480-v secondaries extend to large loads and to selected load centers, which usually are metering points. At these load centers dry-type 277/480-120/208-v autotransformers serve smaller customers. The added transformation was justified economically by elimination of two network vaults and a sizable reduction in secondary cable.

As installation of lightning arresters was not practical in the vaults, they are at cable terminal poles and the sectionalizing center. Although lightning exposure is increased by the length of the overhead line, and cable runs are short, the line is shielded by a ground wire for at least a mile in either direction. Therefore, arresters at the above locations are considered adequate.

Lines are protected by impedance relays for phase faults and directional overcurrent relays for ground faults. Relays are at each terminal of the supply line and on each line section at the sectionalizing center. Relays reclose the sectionalizing breaker after the fault is cleared and line potential restored.

Should a network transformer fail, related line circuit breakers and secondary network protector will



HILLSIDE SHOPPING CENTER is served from a 34.5-kv line. A sectionalizing center was installed to avoid splitting the line which ties two large substations

maintain service continuity. Each dry-type autotransformer supplying 120/208-v service to smaller loads has a 600-v air circuit breaker of sufficient rating to meet the load and interrupting duty at that location.

Old Orchard Shopping Center also has all distribution facilities on the property underground. Approximate demand is 9,000 kw, the largest of any shopping center in the Chicago area.

The building arrangement would have made overhead construction very difficult. Buildings grouped in the center are surrounded by customer parking space. Service vehicles park in several walled service courts. The shopping center has an exceptionally attractive appearance. These factors favored underground distribution.

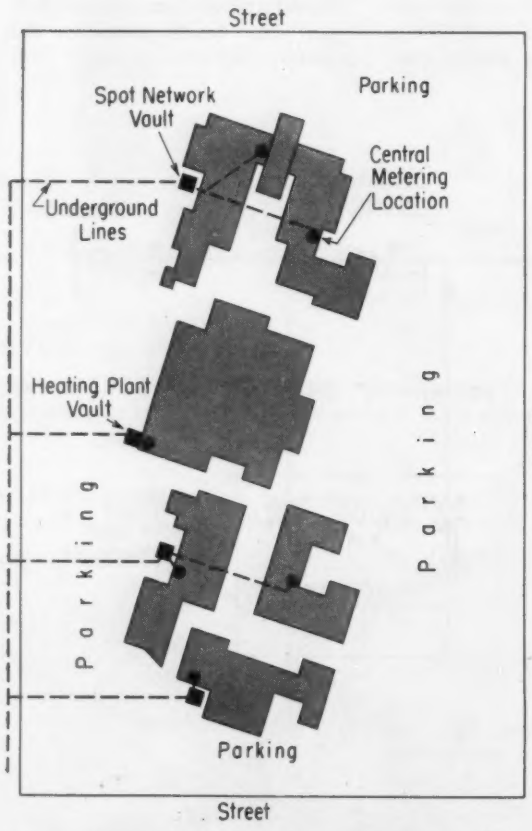
Primary supply at 12 kv proved most economical, although other system voltages were available within reasonable distances. Unrelated load transfers elsewhere on the system made adequate 12-kv capacity available for initial and anticipated loads. Two 12-kv lines serving the center originate at separate buses of a large transmission substation.

Spot Networks are 120/208v

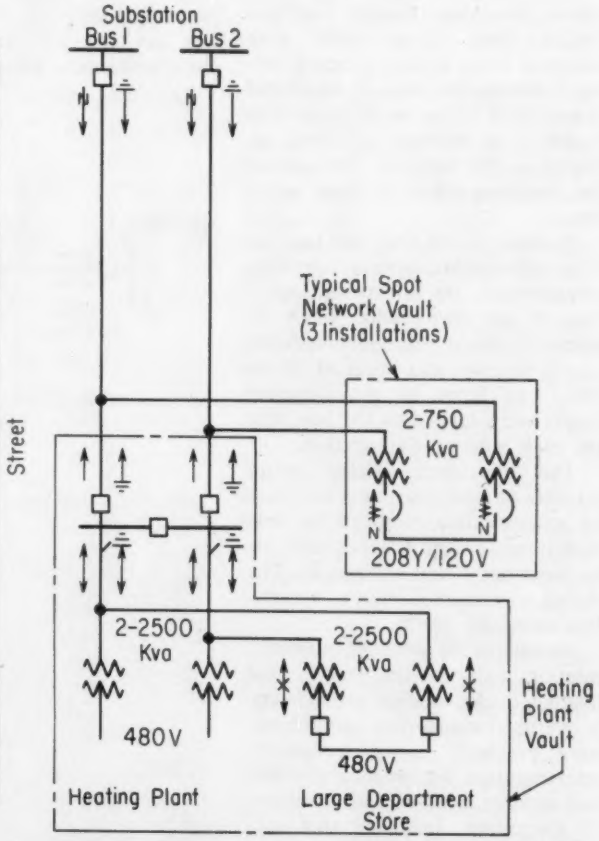
The two largest loads, a large department store and the heating and air conditioning plant, are served at 480 v. Transformers and switchgear for both loads are combined in the centrally-located heating plant vault. Smaller stores are supplied at 120/208 v from three conventional spot-network vaults. Stores are individually metered at central points. Underground lines and spot-network vaults are on easements granted by the shopping center developers.

Line protection is provided by impedance relays for phase faults and directional overcurrent relays for ground faults. Impedance relays operate faster than phase overcurrent relays in common use throughout the overhead 12-kv system. Fault protection at spot-network vaults is conventional. Transformer faults are cleared by line circuit breakers at the substation and by standard protectors on the secondary operated by associated network relays.

The heating-plant vault houses four 2,500-kva conventional transformers, two for each of the largest loads. A 12 kv-bus in this vault has a normally-closed sectionalizing breaker with cubicle-type switchgear. The two heating-plant transformers operate radially while those for the department store are paralleled on the secondary. Nondirectional overcurrent relays on the transformer cable feeders operate line and sectionalizing breakers. Addition of differential relays for the department store transformers assures service continuity to this load should either a line or transformer fail.



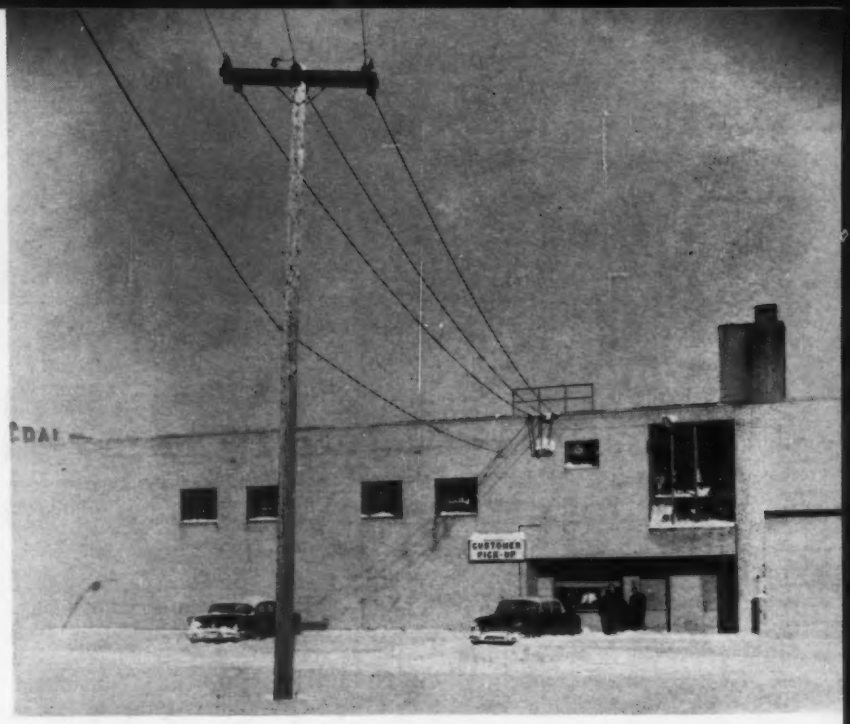
OLD ORCHARD shopping center has building and parking layout which dictated underground primary supply at 12 kv



PRIMARY FEEDS run from two separate buses at a large transmission substation. Total demand is near 9,000 kw

Detroit Edison Uses 3 Methods

- **Underground service for largest centers**
- **Overhead circuits with transformers on roofs**
- **Conventional overhead service to most centers**



LARGE DEPARTMENT STORE in smaller center takes 4.8-kv service to transformer in building. Pole mounted units provide 120/240-v for customer 3-phase loads

W. E. GROVES, Chief Planning Engineer, Detroit Edison Co, Detroit, Michigan

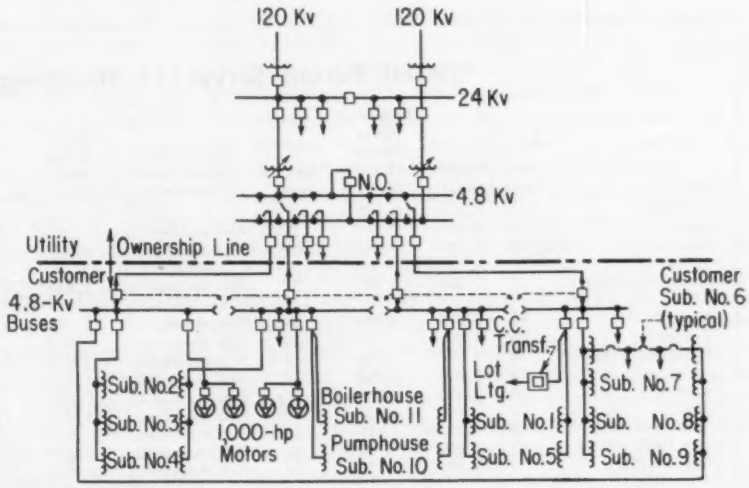
Detroit Edison uses three basic methods of serving shopping centers. The first is underground distribution for the very large shopping centers whose physical layout makes this method the only practical solution. The second is supply from overhead circuits on shopping center property with transformers on building roofs. The third is overhead distribution with transformers on poles on the property, and perhaps one vault in a building. These methods were developed in conjunction with shopping center owners.

The first type of installation supplies the Northland Shopping Center which has one three-story store, a 163-acre site with 54 acres landscaped and parking for 9,200 cars. There is 1,025,000 sq ft of floor space, of which 482,000 sq ft are in the large store.

Power facilities on the shopping center property are underground. The shopping center and a 4-sq mile contiguous area are fed from a 110x200-ft substation site on the shopping center property, adjacent to the service buildings and primary switch house. A face-brick building initially houses 4.8-kv switchgear and two 10,000-kva LTC transformers, with space on the site for an ultimate of four 10,000-kva transformers and additional switchgear. Architecturally the substation conforms with adjacent buildings.

The substation is fed from a 120-kv station about 1½ miles away, over two 24-kv trunk lines. One line is an underground, 350-MCM copper cable, the other a 500-MCM cable with an overhead extension to another substation. Through pole-top switches an alternate feed can be provided to the substation at Northland.

Each trunk line feeds a 10,000-kva LTC transformer supplying a 4.8-kv bus. A normally-open bus-tie



LARGE SHOPPING CENTER takes underground service from a 20,000-kva substation on the property. Substation is fed by two 1½-mile underground cables

4.8-KV AERIAL CABLE feeds distribution transformer banks on the building roof. Structure of the building was designed to support the roof-type installation

breaker on the 4.8-kv bus provides instantaneous, automatic throwover in the event a 24-kv feed or transformer is lost.

The customer's four buses in the primary switch house each are fed by two 4.8-kv 450-MCM copper cables. Should a line fail, the customer's line breaker can be withdrawn and inserted as a bus-tie breaker to restore service to the bus.

The customer's distribution system consists of 10 double-ended substations of two 750-kva, 4,800-120/208-v, 3-phase, 4-wire transformers, with a secondary tie breaker between transformers. The tie breaker is operated normally open but interconnected with transformer secondary breakers for automatic throwover. When the faulty feeder or transformer is restored to service, the load is transferred to manual secondary breaker operation. Two additional feeders serve four 4.8-kv, 1,000-hp motors for air conditioning of the entire shopping center. Peak load at the center has hit 8,500 kva at 92% power factor.

The Monroe shopping center has 24 stores with 157,000 sq ft of floor space. It is served by an overhead, 3-phase, 4.8-kv line tapped to a 4.8-kv distribution circuit from Roosevelt substation, whose connections are similar to those at Northland. The 4.8-kv circuit feeds distribution transformer banks on the building roof, with buildings originally designed to support a roof-type installation.

The largest store buys power through a 4.8-kv, 500-kva, customer-owned transformer bank protected by an automatic breaker in the building. Other stores are served at 120/208 v with meters ahead of each customer's low-voltage distribution panel. Customer-owned services run in conduit to one of three utility-owned transformer banks on the roof. Peak demand was 800 kva for customers served at 120/208 v and 400 kva for the 4.8-kv customer.

Eastgate shopping center has 53 stores and 300,000 sq ft of floor space. Distribution is similar to that at the Monroe center, except that utility-owned transformers are pole mounted. Also, there is some overhead secondary with overhead service drops from pole to building. Because of voltage-drop problems on this type of system, an open-delta transformer connection is used to provide 120/240-v, 3-phase, 4-wire service to customers with three-phase loads.

Three overhead transformer bank installations with 19 transformers have 1,700-kva capacity. The large department store has overhead 4.8-kv service, with three 250-kva and three 167-kva transformers in a vault between the ground and second floors. Primary service is through an automatic circuit breaker.

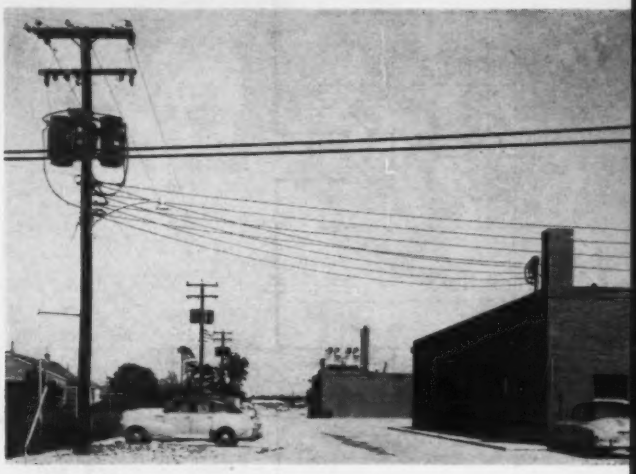
Peak load so far has been 1,340 kva on the secondary service and 760 kva on the 4.8-kv service. This type of installation presents the difficulty of getting the pole line close to the building to reduce the length of heavy services.

Detroit Edison Serves 13 Shopping Centers

Name	Site, Acres	Parking Lot, Cars	Proposed Floor Space 1,000 Sq Ft	Proposed Stores	Distribution Transformer Locations	Transformer Cap, Kva	Peak Demand, Kva Secondary	4.8 Kv	Total	Secondary Service Drops Number	Length, Ft (avg)
Northland	161	7,500	1,000	102	.....	.....	.....	8,500	8,500	...	..
Sears	30	3,000	500	31	Pole Mounted(a)	.....	.....	1,500	1,500	8	15
Seven-Mack	25	1,500	340	17	Pole Mounted(b) & Vault(a)	1,865	1,350	.....	1,350	9	..
Lincoln Park Plaza	21	2,000	300	32	Pole Mounted(b) & two Vaults(a)	1,863	1,100	540	1,640	7	75
Eastgate	33	3,500	300	53	Pole Mounted(b)	1,700	1,340	760	2,100	9	40
Sheldon	36	3,300	230	30	Pole Mounted(b)	900	690	.....	690	9	50
Michigan-Schaefer	10	900*	272	22	Pole Mounted(b)	1,225	1,200	575	1,775	9	70
Northwood	14	1,500	185	25	Pole Mounted(b)	1,725	1,500	.....	1,500	9	35
Monroe	20	2,000	150	27	Building Roof(a)	1,500	800	400	1,200	...	..
Belmont	11	900	150	17	Pole Mounted(b)	1,200	1,000	.....	1,000	7	50
Cherry Hill Plaza	12	1,000	120	30	Pole Mounted(b)	875	676	.....	676	8	40
Lake Shore Village	13	1,200	120	22	Pole Mounted(b)	287	156	.....	156	3	50
Telecraft Plaza	10	500	117	30	Pole Mounted(b)	984	.....	.....	.....	7	50

Secondary Supply: (a) 120/208-v wye; (b) 120/240-v open delta. * Municipal lot.

Small shopping center of 20 stores . . . is fed by 13.2-kv feeder in alley ▶



Vepco Prefers Overhead . . .

. . . with pole line usually located in alley of shopping center. Where overhead is impractical, underground is used if the owner pays for vaults, manholes, and conduit lines

R. C. DAFFRON, Distribution Engineer, Virginia Electric & Power Co, Richmond, Va.

Shopping centers generally are served with overhead distribution facilities by Virginia Electric & Power Co. But where layout of the center, parking area, and access makes overhead impractical, the center is served underground.

Regardless of location of the lines, Vepco endeavors where practical to provide two primary sources, with one usually connected through open sectionalizing equipment for emergency supply. Vepco's policy is to own the secondary distribution to the connection for individual stores. Thus, each service is run separately to the secondary and individually connected, so that it can be disconnected without disturbing other customers.

Overhead lines are located in the service alley as permitted by a permanent easement with rights of ingress and egress. Transformers are cluster-mounted in 3-phase banks; service drops run directly to the grouped service entrances, eliminating secondaries. One small shopping center with 20 stores and 84,000 sq ft of sales floor area is served in this manner. This center has about a 500-kw demand.

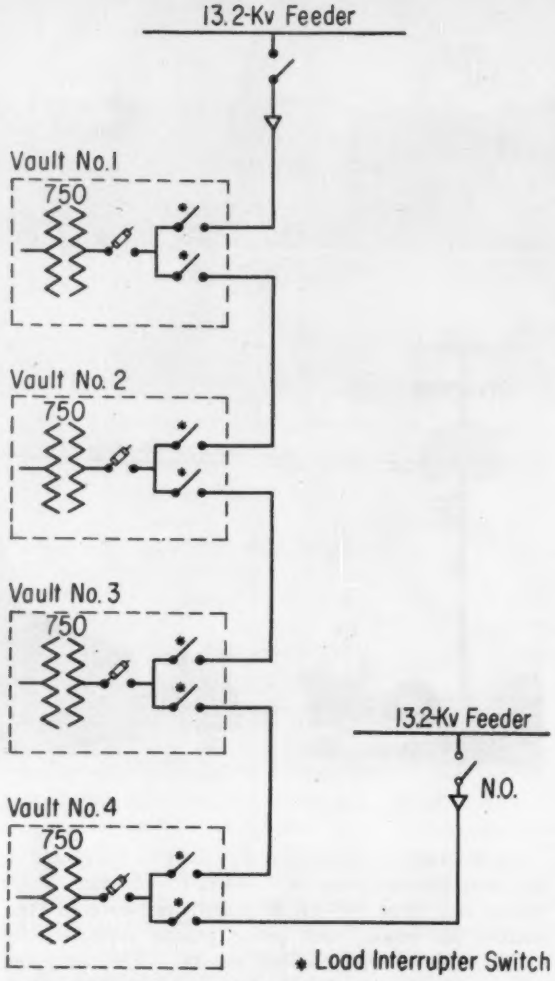
Similar overhead lines serve larger centers with numerous small loads and several large individual 400-kw loads. In one large center, small loads are served from cluster-mounted banks; larger loads are supplied from 750-kva 3-phase transformers on two-pole structures tapping a 13.2-kv feeder. Poles are 25 ft across the alley from the buildings, which permits use of overhead services.

Light weight of aluminum was used to advantage in designing services from the 750-kva transformers. Each service has three 795-MCM polethylene-covered conductors per phase, with phase groups supported by a 336.4-MCM bare ACSR neutral. The shopping center with about a 3,000-kw demand is served from a 13.2-kv feeder connected to another through sectionalizing switches.

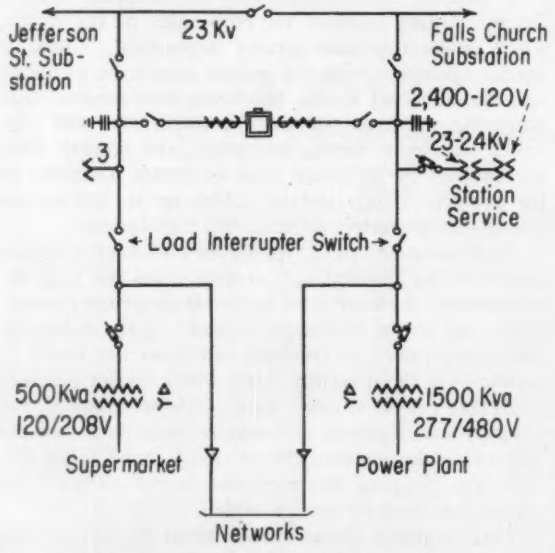
A different approach is used for shopping centers having parking facilities on both sides of the stores, which make overhead service impractical. Under a special agreement with the project owner, he furnishes and maintains all vaults, manholes, and conduit lines according to Vepco's plan. The owner also will construct additional vaults, manholes, and conduit lines as required by increased load or future additions to the project. Vepco installs cables up to service entrances, all protective devices, and transformers.

An installation of this type serves a 44-store shopping center having 254,000 sq ft of floor space and a 2,100-kw demand. As there is no basement or service passage, vaults are in the buildings, adjacent to the driveway. Secondary cables in conduits run from the vaults to manholes in the driveway, from which service conduits and cable run to various stores. For small shops and offices whose loads do not require separate extensions and which do not abut the driveway, hand holes provide for grouping the customer-owned services and connecting them to service cable.

This shopping center is connected to two 13.2-kv feeders through disconnects, one set of which is normally open. Primary cable loops into each vault



MEDIUM SIZED SHOPPING CENTER is fed from an underground system of this type when overhead is impractical



SWITCHING CENTER at large shopping center is designed to carry one transformer per vault in event of fault on feeder

through load-interrupter switches with high-interrupting capacity fuses and a 750-kva 13,200—120/208-v 3-phase transformer tapped to the bus between two switches.

A different underground scheme supplies the largest shopping center, which has 375,000 sq ft of sales area and a 3,200-kv demand. This project occupies 25 acres, with parking for 2,000 cars at different levels. Stores have two floors, one at each parking area level. Under the stores is a below-grade basement with a service truck tunnel through it. At each end of the structure is a three-story department store. Of two smaller unattached buildings, one houses a supermarket. Under it are heating and air conditioning facilities for the project, including three 3,000-hp boilers and a 2-million-gal underground cooling-water and storm-water retention basin.

Layout of the shopping center, plus a request for 277/480-v service to one of the large department stores, dictated servicing the development from a spot network of four vaults. There is one vault for each three-story department store and two more for other stores and shops. All vaults are at basement level with direct access through the sidewalk, with two 1,000-kva transformers and network protectors in each.

Special Switching Maintains Service

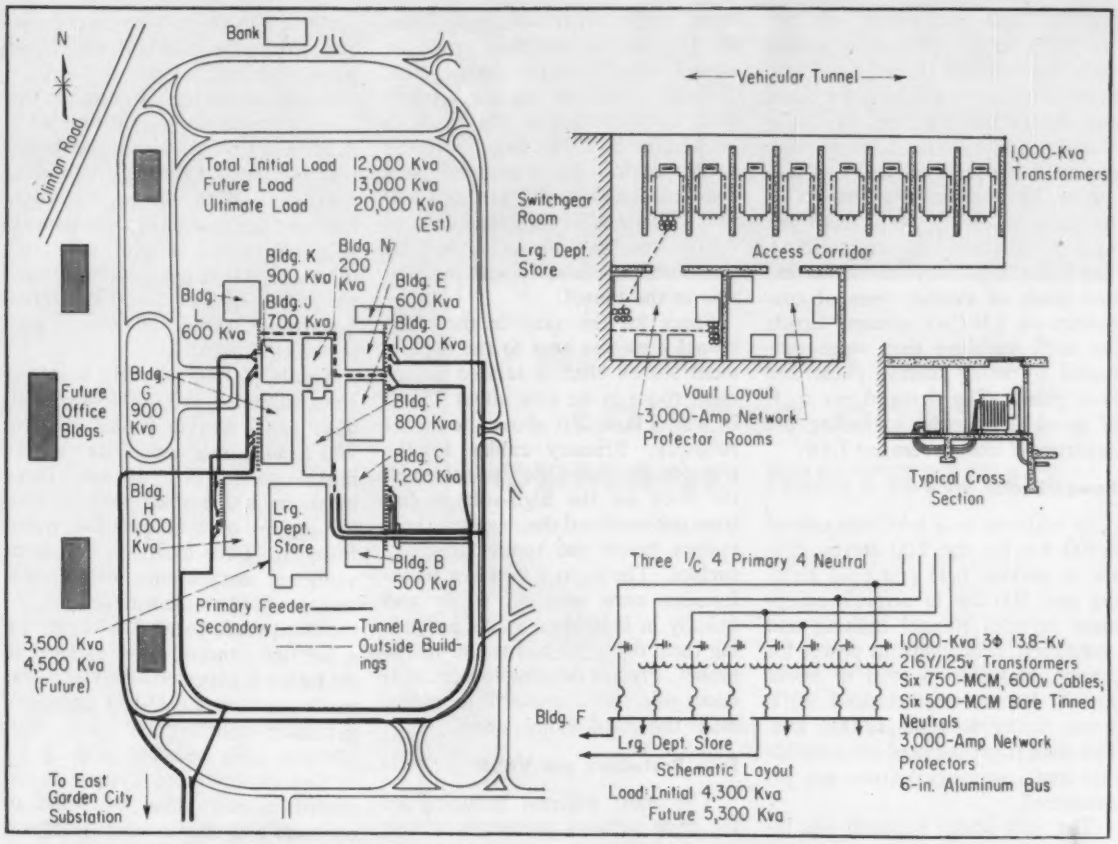
Because only one 23-kv feeder was available, a special switching arrangement was developed to supply one transformer in each vault in case of a feeder fault. The feeder, supplied at both ends, was broken and looped into the switching station through an oil circuit breaker. On each side of the breaker the line extends through a switch to a 34.5-kv cable and then to a network transformer in each vault. The station is arranged for installation of regulators on both cables.

Should either source of power to the shopping center fail, substation and switching station breakers open and the other source feeds a transformer in each vault. If the fault causes considerable outage time, the dead cable can be energized by switching at the switching station.

For a cable fault within the shopping center, the switching station breaker opens and then the substation breaker supplying the fault opens, leaving the unfaulted cable operating. The transformer serving the supermarket and boiler room is in the switching station, connected ahead of the cable terminals. Thus, the faulted cable must be disconnected to restore service to this load.

Secondary service to shops between the two large stores is supplied from facilities in a service corridor running the length of the basement. For the secondary, a low-impedance insulated bus duct consists of two ¼ x3-in. aluminum bars per phase and one bar for the neutral. Bars are tinned to maintain satisfactory joints with the customers' copper connections.

Four sections of 1,350-amp duct extend through the walls of each vault, across the corridor and then pair off in each direction along the corridor. At the half-way point of the run, the section feeding all the load up to that point is terminated. The other section serves the other half of the run. Along the runs, cable tap boxes are spaced where phases are collected and services connected.



ROOSEVELT FIELD SHOPPING CENTER has a second contingency underground plan to furnish the most reliable service. This plan was dictated by the size of initial and future loads and the proposed overall area development

Serves 12,000 Kva Underground

Primary supply at 13.2 kv in steel and concrete conduit serves 120/208-v secondary to existing 12 buildings

R. M. GROGAN, Manager, Transmission & Distribution Lines Dept, Long Island Lighting Co, Hicksville, N. Y.

Coupled with a decade of tremendous residential growth on Long Island, there has been a mushrooming of large suburban shopping centers with compact and complete commercial services, including off-street parking. One of the larger of these is about 25 miles from New York City at historic Roosevelt Field, from which Charles A. Lindbergh began his flight across the Atlantic Ocean.

Early in 1954, developers of Roosevelt Field submitted preliminary plans for a shopping center and office building group with an ultimate estimated load of 17,000 kw. Due to the size of proposed loads and the architectural features of the shopping center, overhead service was considered impractical. A study of several underground system designs showed that the most economical would be a secondary network designed for first contingency operation.

But because of the size of the loads involved and the proposed progressive overall development plan of the entire area, a second contingency underground plan was selected at a slightly higher cost to furnish the most reliable service. Long Island Lighting Co elected to install, own and maintain the distribution system up to the consumer's service cable or conduit take-off point on permanent easements within the center's property lines.

Primary voltages of 13 and 23 kv and secondary voltages of 120/208 v and 240/416 v were considered. System considerations influenced 13 kv as the primary voltage; consumer consultation led to selection of 120/208 v for secondary service voltage. All services are secondary metered. One large department store has a totalized kw demand and totalized kwhr

for its four secondary services.

The basic problem to be solved was determination of individual and group electrical loads, both for initial and future construction. As individual store connected loads were not available initially, a design factor of 10 w demand per sq ft of selling area and 5 w demand per sq ft of basement area was selected. These loadings were based on actual loads of similar types of customers on LILCo's system. Loads for each building then were estimated by using renting plans and floor plans. The demand per sq ft of gross floor area, excluding the department store, averaged 7.5w.

Power Factor 90%

In addition to a load estimate of 9,900 kw for the 100 stores, 500 kw in parking field and road lighting and 500 kw in owner's equipment services (tunnel lighting and ventilation, miscellaneous power for pumps, etc) gave a total of about 11,000 kw at an estimated 90% power factor to total 12,000 kva. This load is exclusive of office buildings and commercial areas not yet completed.

The next design problem was location of transformer vaults and sizing of transformers. The department store presented a unique problem in that the building was laid out for electric service entrance in the truck tunnel area. Two nearby buildings also presented a problem because they were bounded on one side by the truck tunnel and on the other by two other buildings. Thus, the two nearby buildings could be served only from the tunnel area.

Initial load in the department store was estimated at 3500 kva with an additional 1,000 kva for future load. Loads in the nearby buildings were estimated at 680 kva and 830 kva. Thus a total combined load of 6,010 kva was to be served by transformers whose logical location was in the tunnel.

Space for the vault in the truck tunnel area was next to the department store's electric service equipment room in an area about 25x40 ft, with a floor 3 ft above the tunnel roadway. Primary cables to the transformers enter the vault through the floor on the high-voltage end from conventional duct and manhole system below the tunnel roadway surface. The eight 1,000-kva transformers were installed easily and quickly in individual vaults by sliding them off a flat bed trailer in the tunnel. Precast removable 8-in. high door sills, later grouted in place, made the installations possible.

Four Protectors per Vault

The most efficient grouping of the eight network protectors was in groups of four in a U-shape in two 10x13x10-ft compartments. Entrance to the compartments is on the open end of the U. Previous experience indicated substantial savings might be realized if aluminum instead of copper paralleling bus were used to connect protectors and building services. A bus design resembling an H in cross-section was selected as the standard 3,500-amp network paralleling bus.

Loads of five buildings on the east side of the center were estimated at 3,000 kva (initial) with future buildings (within a 1,000-ft distance) at 500 kva. With this concentrated load and the possibility of basements being developed as sales areas, two locations 800 ft apart were selected for groups of four 1,000-kva transformers and associated network protector equipment.

Loads of four westerly buildings were estimated at 3,000 kva (initial) with 1,000 kva in future load, of which 800 kva would be at the north end 1,500 ft distant. Three locations 500 ft apart were selected for groups of four 500-kva transformers. Two locations are conventional installations with protectors mounted on the transformer. At the third vault, located to the north, a heavier concentration of load in the future is expected. Provision was made for four 1,000-kva units and protector compartment, with four 500-kva units installed initially.

The underground system is installed in more than 30 miles of concrete and steel conduit interconnecting cable manholes, transformer vaults and network protector compartments. Total transformer capacity of 22,000 kva is connected to the four 13.2-kv primary circuits to supply secondary mains to the buildings, where substantial secondary services connect to a meter room.

Demand is 2,100 Kw

Primary feeders, transformers and network protectors were placed in service by July, 1956. As the shopping center is not yet fully occupied and few stores have been open for more than a full year, complete load information is not available.. Customer demands during 1957, excluding the large department store, reveal total loads averaging 6 w per sq ft of gross floor area, as compared with the design estimate of 7.5 w. The department store has a summer and winter demand of 2,100 kw, or 7 w demand per sq ft of selling area and 6.5 w per sq ft of gross floor area. This demand is only 50% of connected load. Services are being connected at a rate which should produce the anticipated 12,000 kva.

Building Areas and Loads at Roosevelt Field

Building	Square Feet of Floor Space: Total Gross	Basement	Remainder	Selling	Demand, Kw
A*	625,000	125,000	200,000	300,000	3,000
B	75,000	29,000	23,000	23,000	375
C	191,000	67,000	62,000	62,000	955
D	161,000	65,000	48,000	48,000	805
E	89,500	29,500	30,000	30,000	450
F	150,340	33,300	43,200	73,840	765
G	146,500	33,300	41,200	72,000	745
H	167,600	66,600	50,500	50,500	835
J	115,200	31,200	28,000	56,000	595
K	121,600	41,600	35,000	45,000	765
L	88,600	29,300	29,300	30,000	450
N	32,900	12,500	10,400	10,000	165
Total	1,964,240	563,300	600,600	800,340	9,905

* Large department store

REGISTERS GIVE LOWEST COST DEMAND METERING

This mechanical register gives meter men accurate demand metering at a lower cost than with any other type of demand device. Low cost is vital now as more demand metering becomes needed to meet the growing number of short-term, high-peak loads. That's why meter men in increasing numbers are finding real savings by using General Electric demand registers. There are savings on costly inventories as high as 30% because with registers, any watthour meter can be quickly and easily converted to a demand meter as accurate as the watthour meter itself. Easy conversion of registers to different scale classes, ratings, and time intervals makes possible substantial savings in operating costs. Testing costs are lower too. Registers can be tested in the field—there's no need for expensive shop testing as with other types of demand devices. See these savings yourself. Ask your General Electric Apparatus salesman to show you the facts on demand registers—the lowest cost way to accurate demand metering. Or, write to the General Electric Company, Section 628-3, Schenectady 5, N. Y.

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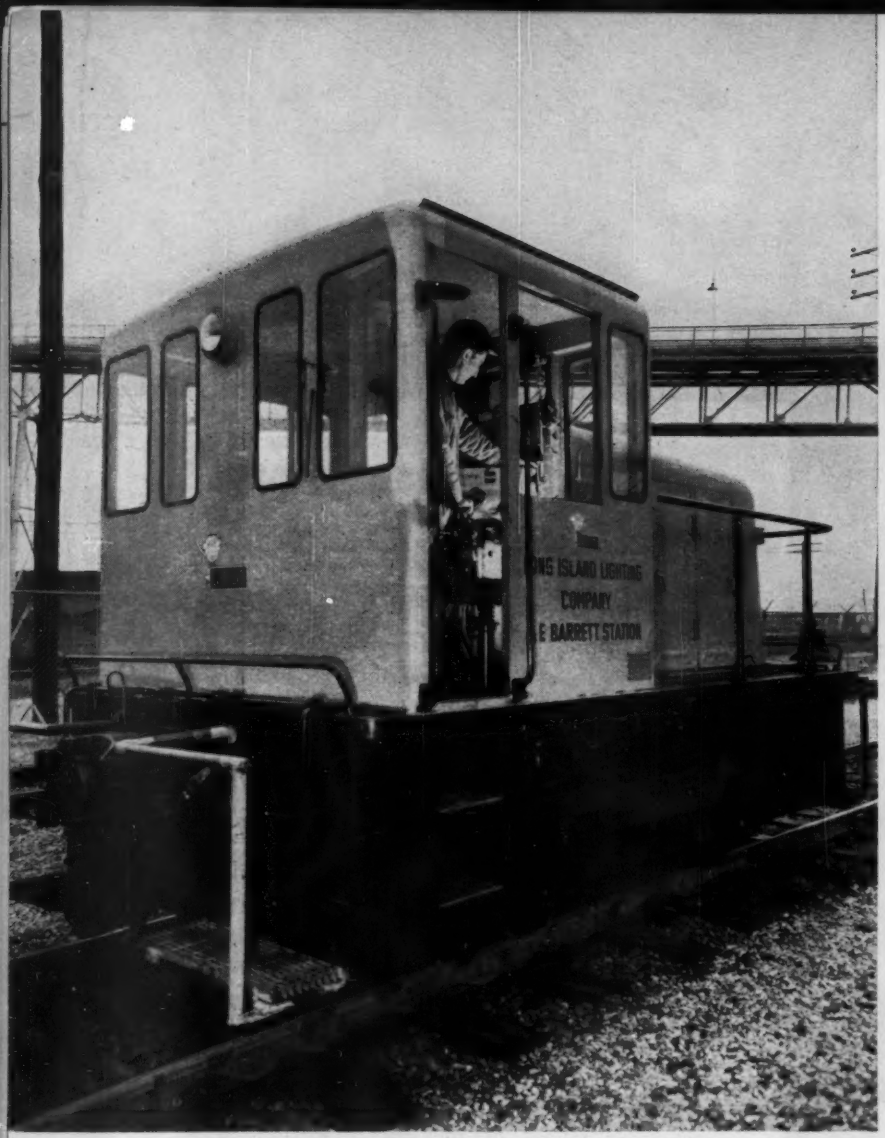
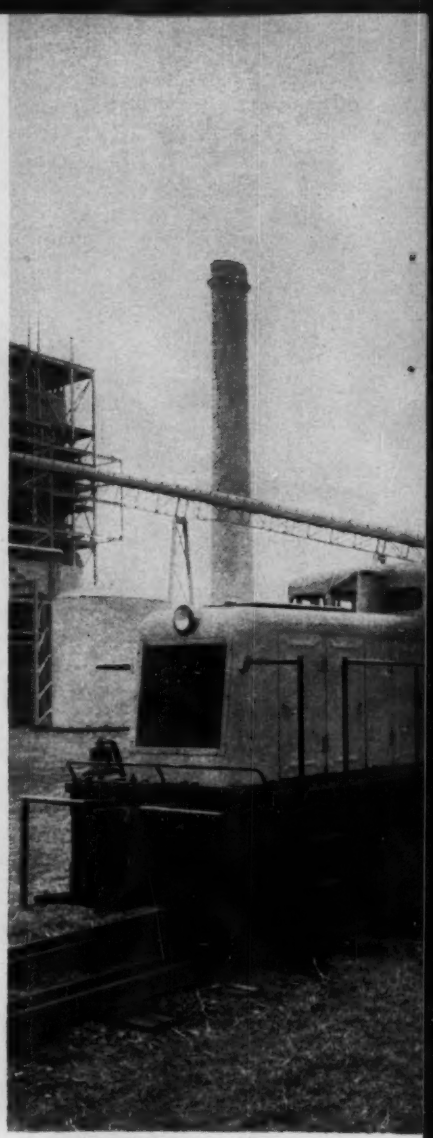


A PUSH OF THE STARTER BUTTON starts up LILCO's 25-ton G-E locomotive on the coldest of mornings. Such efficient operation means high availability. LILCO Plant personnel like a unit that can be counted on for all haulage jobs.



FAST SWITCHING AND COUPLING of heavy coal cars is made possible by G-E Electric Drive. There's a smooth

Switching Generating Station Cars
With a General Electric Locomotive . . .

How 150 hp Helps LILCO Produce 156,250 kw

flow of power in LILCO's 25-ton diesel-electric locomotive because all components and operations are simple.

SUFFICIENT POWER IS AVAILABLE from LILCO's 25-tonner to meet all of the E. F. Barrett Generating Station needs. G-E Specialists helped LILCO choose a unit that would not waste power by carefully studying LILCO requirements.

The operation of Long Island Lighting Company's new 156,250-kw rated E. F. Barrett Generating Station in large part depends upon the efficient movement of materials. The movement of coal . . . the movement of heavy replacement equipment . . . the movement of generator parts during overhaul—all are key operations at the Barrett Station

For these many different material handling jobs, LILCO uses a General Electric 25-ton, 150-hp diesel-electric locomotive.

STATION OPERATING PERSONNEL like the ease with which their 25-tonner works. They like the high availability of their locomotive with its low maintenance and fuel cost. They like the use of G-E Electric Drive which results in fast, efficient locomotive operation.

LILCO MANAGEMENT is pleased with the performance of their new locomotive, too. The high return on their initial investment has proven to them that it was good economics to put a General Electric locomotive on the job.

A FREE SURVEY OF YOUR GENERATING STATION MATERIAL HANDLING REQUIREMENTS can show how you too could save with a General Electric Locomotive. For such a free survey, contact your nearest General Electric Apparatus Sales Office. Locomotive and Car Equipment Department, General Electric Company, Erie, Pa. 120-102

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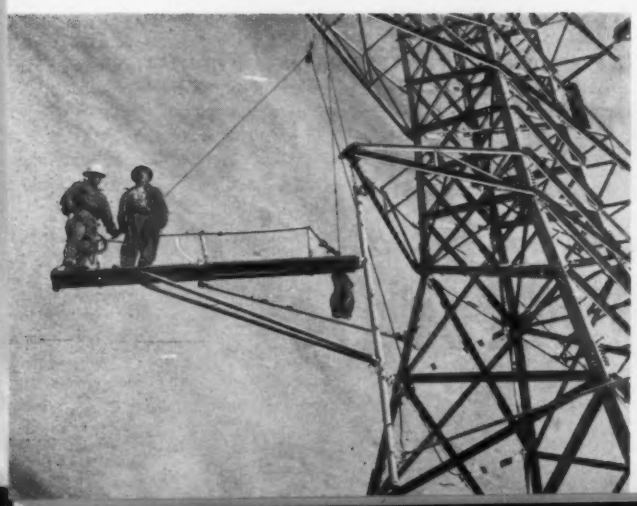
How to Lift Hot Lines for House-Moving Job

An easy method of raising wires for house-moving jobs employs a double-arm pole chained to the A-frame of a truck.

The cross-arm is fastened to the top of the pole with a single through-bolt. Thus a lineman on the ground can keep the crossarm horizontal by manipulating hand-lines attached to the double-arming bolts. Steel pins on the crossarm hold the conductors apart. The pole is cross-bolted below the crossarm to prevent splitting.

Hydraulic controls on the truck lift the pole, bringing the crossarm up under the wires which are to be raised. Although the pole and crossarm should be dry, rubber line hose is used on the conductors where they contact the arm.

Montana-Dakota Utilities Co devised this scheme when a 39-ft-high house was moved past 3-phase 2,300-v lines. The company saved a considerable amount of time, avoiding the de-energizing of lines and the setting of temporary poles.



Free-Swinging Rig Aids Tower Work

This home-made tower rig gives line stringers greater freedom and safety in making cable connections at high altitudes. Designed by Dallas Power & Light Co, the rig swings through a 180-deg arc on an aluminum pole attached to the tower.

(*More How To on page* 86)

BETTER PROTECTED AIR OPENINGS—"High up" air intake passages of new G-E motor prevent snow, trash, dust or dirt from being drawn into motor. Passages do not clog. Side intake and end exhaust prevent recirculation, allowing side-by-side mounting with minimum spacing.

General Electric Announces...

ALL-NEW WEATHER PROTECTED MOTOR

Wind, rain, snow, and even hurricanes, are little hazard to General Electric's *new* Weather Protected Motor—first major redesign of weather protected motors since their 1948 introduction.

General Electric's new design offers you the best outdoor protected drive available for your motor needs. Just install it, and don't worry about it when adverse weather strikes.

ALL-WEATHER PROTECTION built in the new design is the result of a unique top intake and exhaust ventilating system which utilizes a labyrinth baffling system to remove contaminants before air reaches motor interior. Incoming air is required to make a series of right-angle turns and reductions in velocity before entering motor interior.

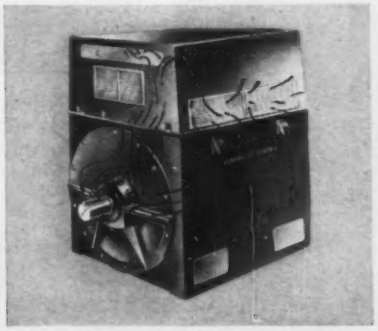
The new design, developed in G.E.'s Medium AC Motor and Generator Dept. to meet or exceed NEMA Type II definition, has passed a series of "hurricane tests," during which tons of water were hurled on the motor at wind velocities up to 100 mph. At completion of tests no moisture had entered the motor interior. Danger of pressure build-ups during severe storms is reduced by special "blow-through" passages for high velocity winds.

FOR MORE INFORMATION on this modern motor design, consult your nearby G-E Apparatus Sales Office or write to Medium AC Motor & Generator Dept., Section 882-7, General Electric Co., Schenectady, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

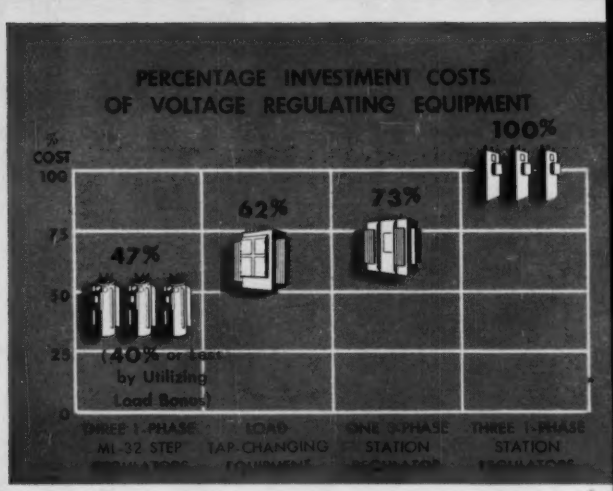
TOP ACCESSIBILITY—Air passages in top section are completely accessible through nine openings. Filter installation, inspection or replacement is fast and easy.



EFFECTIVE DIRT REMOVAL—Ventilating system of new Weather Protected Motor prevents dirt, moisture and other contaminants from entering motor interior.

SIMPLIFIED MAINTENANCE—Removable, lightweight end shield permits complete accessibility to motor interior and bearings without disturbing alignment.

New Higher Ratings make...



COMPARE THE COST figures on the chart above and see how the application of ML-32 single-phase regulators can reduce substation regulation cost by as much as 60% compared to other types of regulation.

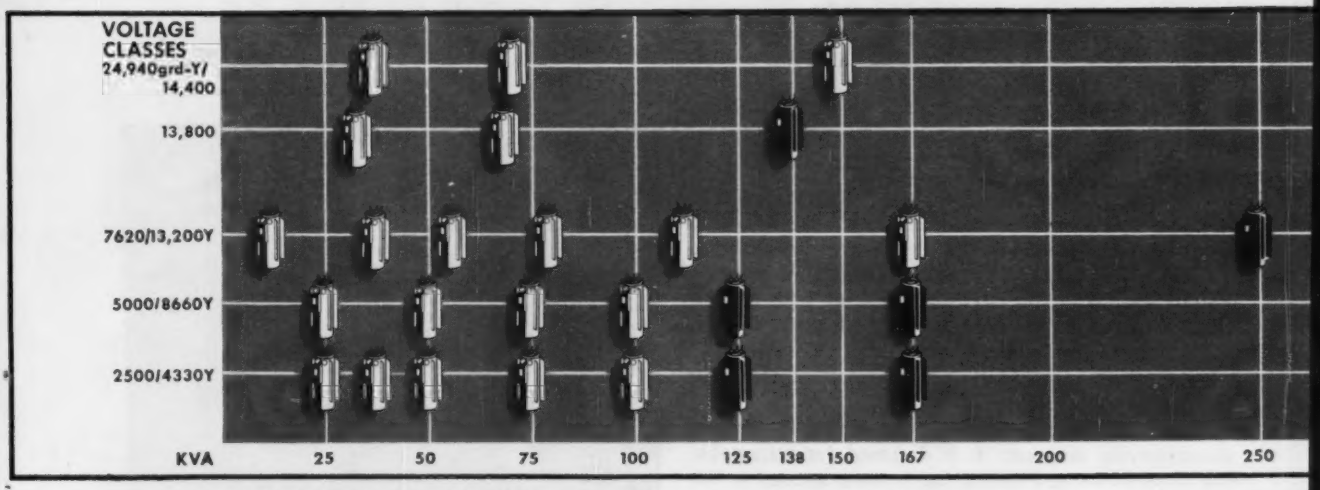
New ratings of G-E single-phase step regulators permit application of ML32's in larger substations . . . Save up to 60% of the cost of station regulation equipment!

The trend is to greater use of low-cost single-phase regulators in substations, and General Electric is meeting the demand. The new extended single-phase step regulator line provides new 125- and 167-kva ratings in the 2500- and 5000-volt classes, a new 250-kva rating in the 7620-volt class, and a new 138-kva rating in the 13,800-volt class for greater substation economies. As much as 60% can be saved on your regulation investment, and you also get individual phase regulation and increased savings through deferred investment in line rebuilding.

In addition, at reduced regulation ranges, a new Load Bonus (extra current capacity) of ***480 amperes*** (up to 160% of rated current) is now available on 2500-volt units rated 75 and 100 kva.

Remember, the price of substation regulation, using ML-32's, is less than that of other types of regulation. You'll want to know more about the quality and economy available in the ML-32; write to Section 423-25, General Electric Company, Schenectady, N. Y., or contact your nearest General Electric Apparatus Sales Office.

General Electric Regulators Cost Less On The Line



THE EXTENSION OF ML-32 RATINGS to 250 kva (new ratings shown above in black) gives you a new opportunity to provide low-cost regulation on your growing feeders. Growing load, plus demands for economy, can be met when you specify ML-32's for your substation regulation. They cost you less on the line.

Progress Is Our Most Important Product

GENERAL ELECTRIC

How to Cut Time of Reading Demand Charts

A plastic device which eases the task of reading 7-day circular demand meter charts knocked down a 4,000-manhour task to 1,000 manhours for Arizona Public Service Co.

The company, in making a residential load research survey, recently required 173,376 readings of 15-min demands from demand meter charts. Part of the data to be tabulated was the hour of the maximum daily demands. But the curved path traced by the pen made exact time determination very difficult when the pen did not approach the time scale on the chart periphery.

In previous surveys, the reader used a curved piece of paper to line up chart markings with the corresponding hourly scale. However, this was a tedious and ticklish adjustment.

Bill Flower, rate department analyst, solved the problem with a simple device—a plastic arm which rotates around the center of a plastic disc. A curved hairline time arc etched in the arm follows the chart markings when the chart is placed on the disc. The readings are made as the operator moves the arm and hairline through the numbers on the periphery of the chart.

Simple Tube Protects Fluorescent Lamps

J. D. VAN KIRK, Station Lighting Attendant,
J. D. RICKEY, Lineman, T&D Dept,
Ohio Power Co, Portsmouth, Ohio

A container to hold several fluorescent tubes during street-light maintenance reduces up-and-down handling and the attendant possibility of dropping the tubes. The cost of modifying a mailing tube into the container was about $1 plus 30 min of labor.

The 6-ft-long, 6-in.-diam tube was shellacked after a wood bottom and a hook at the top were added. The container is hung at a convenient location on the raised ladder of the service truck.

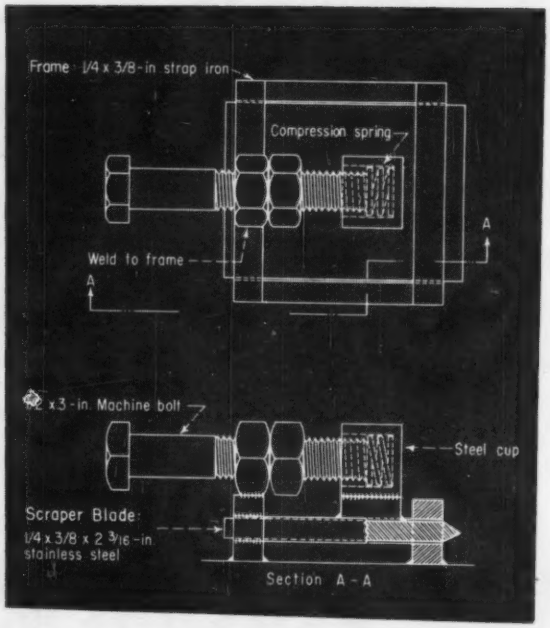
Blower-Tube Scraper Saves Time and Money

C. F. YONKERS, Junior Maintenance Man, Kyger Creek Station, Ohio Valley Electric Corp., Gallipolis, Ohio

Cleaning time and seal replacement costs are saved at Kyger Creek Station with the use of a self-adjusting scraper for slag-blower tubes. The scraper prevents the accumulation of hard slag on the retractable blowers, thereby eliminating the need for replacing seals around them. The device required less time to build than is needed in cleaning one blower tube. It saves 832 man-hr annually per boiler plus the cost of replacing seals every two weeks.

Details of the scraper assembly are shown in the accompanying diagram. It is designed for retractable slag blowers located below the bottom screen, in the hottest section of the boilers. Need for the device arose following experience at Kyger Creek, in which a hard slag built up on the blowers after a few operating cycles. The slag accumulated until it tore out the wall box seals upon retraction of the blower. Loss of the seals allowed hot gases to escape into the boiler room.

New seals could not be installed until the hard coating was removed. This, plus installation of new seal, required 16 man-hr every two weeks.



He Can "Measure" More Profit For You.

This Dowell service engineer can measure the amount of scale he removes from a line, using the Dowell method of chemical cleaning. *This removed scale and sludge can also be measured in increased profit dollars for your company.*

Example: Scale build-up in the main water supply line of a major Midwestern plant had reduced the "C" factor from 105 to 72. This situation became apparent just at the start of the peak season for the company. Management had a choice between laying an auxiliary line or trying to clean their present one. They decided to clean the line—but not the old-fashioned mechanical way. Time would not permit. Dowell was called in to do the job—chemically.

Dowell Service was fast—the job was done in three days. Dowell Service was effective—the "C" factor was increased to 92. Dowell Service was profitable for the customer—$71,000 was saved and the company's annual profit was protected.

With Dowell Service you receive the benefits of more than fifteen years experience in chemical cleaning—plus a full line of equipment, chemicals, and trained personnel. You pay one charge, get an efficient job, handled by experienced people.

Your maintenance and operating engineers probably know about Dowell Service. Ask them for the facts. Decide for yourself about the additional profit possibilities to your company with Dowell Service working for you. DOWELL INCORPORATED—A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY. Headquarters and research center, Tulsa, Oklahoma, with 165 offices and stations to serve you.

Chemical cleaning service for industry DOWELL

It costs less to keep the way clear with a special "crew"...

Dow Brush and Weed Killers

Outages are always an expense. But repair crews won't have to waste valuable time fighting their way to the source of trouble if you clear the way first with Dow brush and weed killers.

A planned program of chemical vegetation control along your right-of-ways not only does a cleaner, more complete job than cutting, it costs less in the first place . . . and keeps on decreasing

in cost from year to year.

The real secret to this economy of chemical control is in the line of specialized Dow chemicals that are job-tailored to do a better job for less. Veon* 100, for example, provides economical control of brush and weeds with greater safety in areas near susceptible crops. Esteron* 245 O.S. is effective against a wide variety of brush and may be applied any time of the year. Kuron* excels in brush stands that are predominantly oak and maple.

These and other Dow brush and weed killers can help you keep capital clearings clear, reduce outage time and maintain your full rights to your right-of-ways.

Get all the facts before your crews cut another foot of right-of-way. This free booklet, "Utility Vegetation Control", will show you how the Dow chemical "crew" can clear the way at lower cost. Write to: THE DOW CHEMICAL COMPANY, Agricultural Chemical Sales Dept., Midland, Michigan.

*Trademark of The Dow Chemical Company

YOU CAN DEPEND ON DOW

A Method to Phase-Out Transformers

This method of solving transformer phasing problems consists of the orderly application of a few simple fundamental principles. Examples are included

LEON BILK, Electrical Engineer, United Engineers & Constructors Inc, Philadelphia, Pa.

Transformer phasing problems involve the identification of the phases of various voltages so that vector diagrams can be drawn, or so that pairs of conductors with like phase can be interconnected. In this method the phase identification is made from a column of voltages that have the same phase. The column is written on the basis of three principles. First two principles are merely statements of the definitions of standard transformer markings and nameplates. The third principle is axiomatic.

Examples given are for voltages in 3-phase systems, but the method is by no means restricted to just such systems. In conjunction with Kirchoff's laws, it is suitable for solving instrument transformer problems.

NOTATION

1. The voltage between any two conductors is represented by the markings of the conductors.

Examples: AB represents the voltage between bus A and bus B. X_1X_2 represents the voltage between terminal X_1 and terminal X_2.

2. Voltages listed in a vertical column are in phase.

Example: $\begin{matrix} X_1X_2 \\ A\ B \end{matrix}$ is read: Voltage X_1 to X_2 is in phase with voltage A to B. In other words, at the precise moment X_2 has maximum positive potential with respect to X_1, B has maximum positive potential with respect to A.

Note: If $\begin{matrix} X_1X_2, \\ A\ B \end{matrix}$ then $\begin{matrix} X_2X_1. \\ B\ A \end{matrix}$

PRINCIPLES

Principle 1. Single-Phase Transformers (Fig 1).

$$X_1X_2 \qquad X_2X_1$$

and

$$H_1H_2 \qquad H_2H_1$$

This is true regardless of whether the transformer has additive or subtractive polarity.

Fig. 1—Single-Phase Transformer

Principle 2. Three-Phase Transformers (Fig 2).

Phase relationships are given by the transformer nameplate. Voltages represented by vectors drawn in the same direction are in phase. (These parallel vectors represent voltages across windings linked by the same flux).

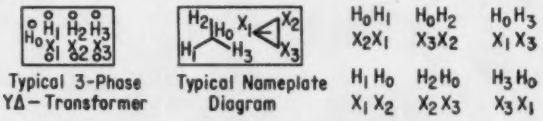


Fig. 2—Three-Phase Transformer

Principle 3. Voltages between sets of conductors electrically connected together are in phase (Fig 3).

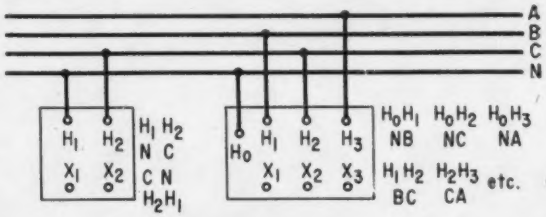


Fig. 3—Voltages in Phase

PROCEDURE

1. Make a diagram showing all information given, e.g., connections, terminal markings, vectors, nameplates.

2. Using the principles given above, list in separate vertical columns the voltages which are in phase. **Important:** List each voltage.

3. Assuming sufficient information has been given, these lists of in-phase voltages will contain the information required to complete the solution. For example, if the problem calls for finding the vector diagram, the lists will indicate to which given vectors the new vectors should be drawn parallel. If the problem calls for completion of connections, the lists will show the pairs of conductors which are in phase and may be connected together.

(*Continued on page* 92)

WAGNER TRANSFORMERS . . . THE CHOICE OF LEADERS IN INDUSTRY

Rotary kilns at Missouri Portland Cement Company.

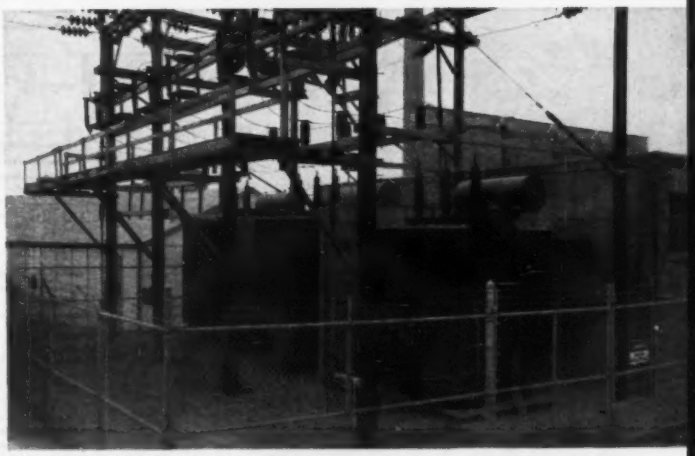
Missouri Portland Cement meets increasing power needs... provides for future expansion!

In 1949, Missouri Portland Cement Company completed a modern power distribution system to meet its demand for electricity. Its main substation provided 12,000 kva of transformer capacity—supplied by two Wagner Power Transformers—which could be raised to 16,000 kva by the use of cooling fans. The system also included five unit substations—powered by Wagner Unit Substation Transformers.

Since that time a need for increased production brought about the installation of a third rotary kiln, and even 16,000 kva was inadequate.

This pressing need for power was met by the addition of a third 6000/8000 kva Wagner Power Transformer, and by an additional Wagner Unit Substation Transformer for the load-centers.

Wagner Power and Unit Substation Transformers can meet your power needs just as they do at Missouri Portland Cement Company. Ask your nearby Wagner Sales Engineer to help you plan for your power needs. Call the nearest of our 32 branch offices, or write us.



TRANSFORMER TRIPLETS... BORN 8 YEARS APART

These three Wagner Power Transformers in the main substation at Prospect Hill, are identical—although the third unit was built eight years after the first two. They meet the tremendous demand for a dependable flow of power for Missouri Portland Cement Company.

Wagner Electric Corporation
SERVING INDUSTRY SINCE 1891

WT58-A

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wagner Electric Corporation
6456 PLYMOUTH AVENUE, ST. LOUIS 14, MO., U. S. A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

PROBLEMS

In the following problems, the symmetrical and more common arrangements are avoided in order to reduce the reader's tendency to jump to conclusions.

Solid lines ———— indicate given information.

Broken line — — — indicate derived information.

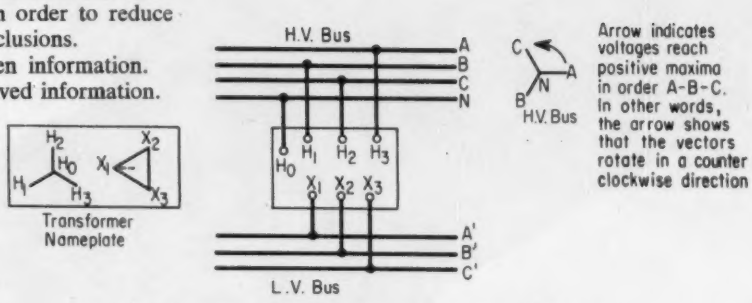


Fig. 4—Connections for Problem 1

Problem 1. Find the low voltage bus vectors in Fig 4. In Fig 4 and 5 the angle between the vector drawn from the center of the triangle to A′ (neutral to A′) and the vector NA is the "angular displacement" between the two sets of vectors.

The angular displacement between the two sets of vectors in Problem No. 1 is 150 deg. In other words, the high voltage leads the low voltage by 150 deg. This situation may seem a bit strange, but it actually does exist on an eastern utility system.

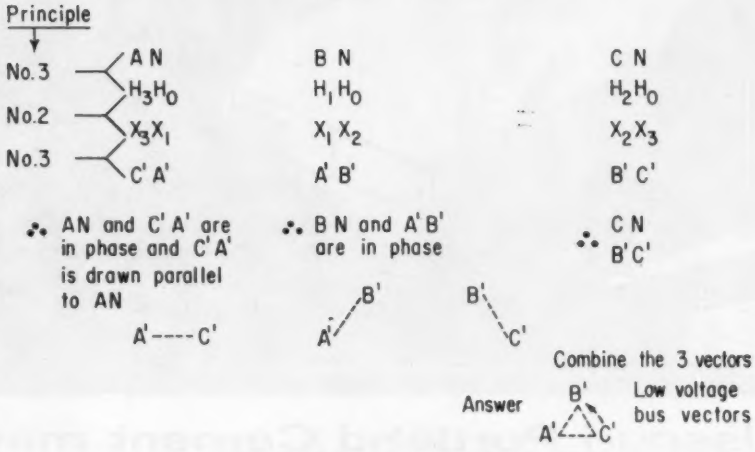


Fig. 5—Solution to Problem 1

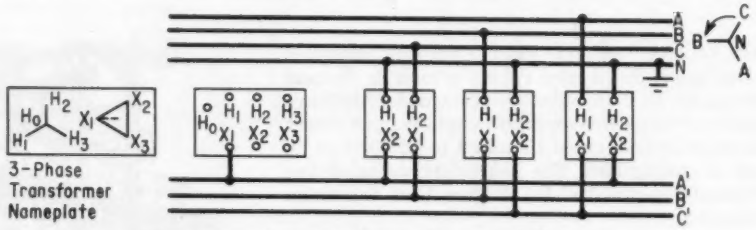


Fig. 6—Connections for Problem 2

Problem 2. A plant has three single-phase transformers connected as shown in Fig 6. A 3-phase transformer having the proper turn ratio, taps, impedance, and reactance to resistance ratio is purchased for operating in parallel with the single-phase transformers. Complete the connections.

Suggestion: First determine the bus vectors from the single-phase transformer connections.

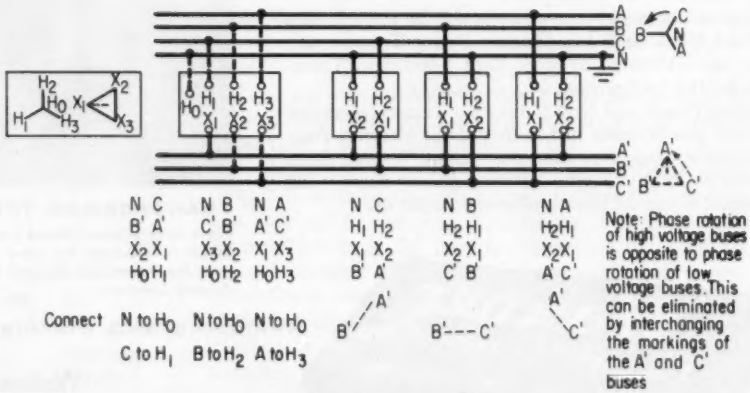


Fig. 7—Solution to Problem 2

TONIGHT... new lights shine in America

Nation's First Commercial Electricity Produced From Atomic Power

It happened December 18, 1957, at Shippingport, Pennsylvania, U.S.A.

Not the familiar flash of a nuclear explosion but a silent surge of controlled power went out over the lines of Duquesne Light Company of Pittsburgh as the nation's first full-scale atomic power plant began to produce electricity for man's peace and progress. And around the world thoughtful men marked a new date on civilization's *constructive* calendar.

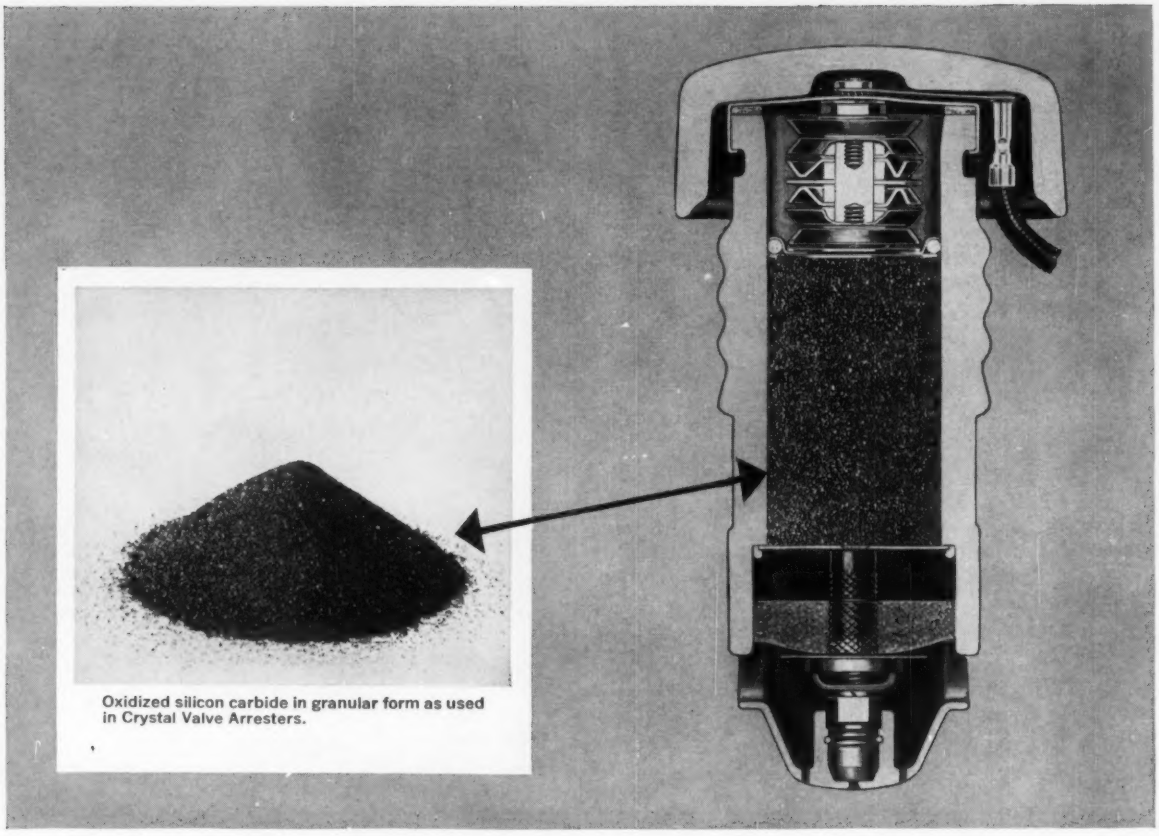
Heart of this 60,000 kilowatt plant lies below the ground in the core of the pressurized water reactor designed by Westinghouse Electric Corporation, prime contractor for A.E.C. Stone & Webster Engineering Corporation served Westinghouse as architect-engineer to develop the structural designs and construction drawings for the nuclear plant and to inspect the construction work.

Write or call our nearest office for information as to how our experience can be of assistance and profit to you.

STONE & WEBSTER ENGINEERING CORPORATION

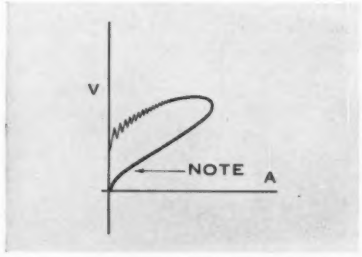
A SUBSIDIARY *of* STONE & WEBSTER, INC.

New York Boston Chicago Pittsburgh Houston San Francisco Los Angeles Seattle Toronto

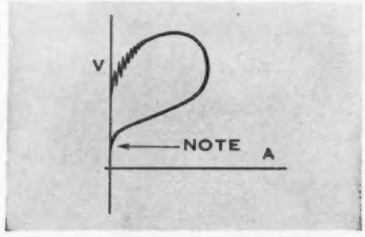


Oxidized silicon carbide in granular form as used in Crystal Valve Arresters.

Why CRYSTAL VALVE ARRESTERS outperform all other lightning arresters



Volt-ampere curve of ordinary valve element. Note that current is not cut off until voltage approaches zero.



Volt-ampere curve of Crystal Valve element. Current is cut off at voltage above zero.

No other lightning arrester has the oxidized silicon carbide valve element that spells the difference in performance for famous Crystal Valve Arresters.

This valve element, composed of optimum-sized granules of oxidized silicon carbide, exhibits unusually high resistance recovery after lightning surges, and very high conductivity to impulse response. As shown by the volt-ampere curves at left, Crystal Valve Arresters cut off current at a voltage above zero, giving a more positive cut-off than is possible with other valve materials.

This balanced combination of resistance and conductivity in Crystal Valve Arresters eliminates the need for a special-type gap to interrupt heavy follow currents; prevents fuse-coordination problems and end-turn failures in transformers. Finally, the Crystal Valve Arrester can cut off higher voltages without failure.

Get the whole story about the efficiency of Crystal Valve Arresters. Call your nearest Delta-Star office or write to *Delta-Star Electric Division, H. K. Porter Company, Inc., 17th & Cambria Sts., Philadelphia 32, Pa. District offices in principal cities.*

H. K. PORTER COMPANY, INC.

DELTA-STAR ELECTRIC DIVISION

Connors Steel, Delta-Star Electric, Disston, Forge and Fittings, Leschen Wire Rope, Quaker Rubber, Refractories, Riverside-Alloy Metal, Vulcan-Kidd Steel, H. K. Porter Company (Canada) Ltd.

Steel Casting Production to be Increased 50% by GE

Plans for establishment of a $3,700,000 large steel casting foundry to help meet the increasing needs of the electric industry were announced recently by General Electric's Foundry Department. This new facility will be located in the present iron foundry building in Schenectady.

According to E. R. Oeschger, department general manager, capacity for manufacturing the larger iron castings will be retained as an integral part of the new facility.

Re-equipping the present 95,000-sq ft building is scheduled to begin this summer and to be completed in 1960.

The expansion program will permit the foundry department to increase production about 50% over present level, and to produce steel castings weighing up to 85,000 lb. Present steel foundry facilities produce castings up to 35,000 lb.

Scheduled for installation in the foundry will be an electric arc furnace capable of melting over 200,000 lb of steel or high grade iron. This will be equipped with an induction stirring device to insure uniformity of temperature and decrease impurities in the melt.

Sangamo Producing Secovars in Volume

Secovar capacitors are in full volume production at Sangamo Electric Co's Pickens, S. C. Division. Shown is the first unit to come off the production line. It is being examined by W. G. Dorsett, plant manager at Pickens, J. A. Muir, Jr., mechanical engineer, and R. R. Wylie, Sangamo's marketing manager.

Muir is holding a Type S, 240-v, 2-kvar Secovar which can be plugged into the customer's meter socket to relieve the var load all down the line.

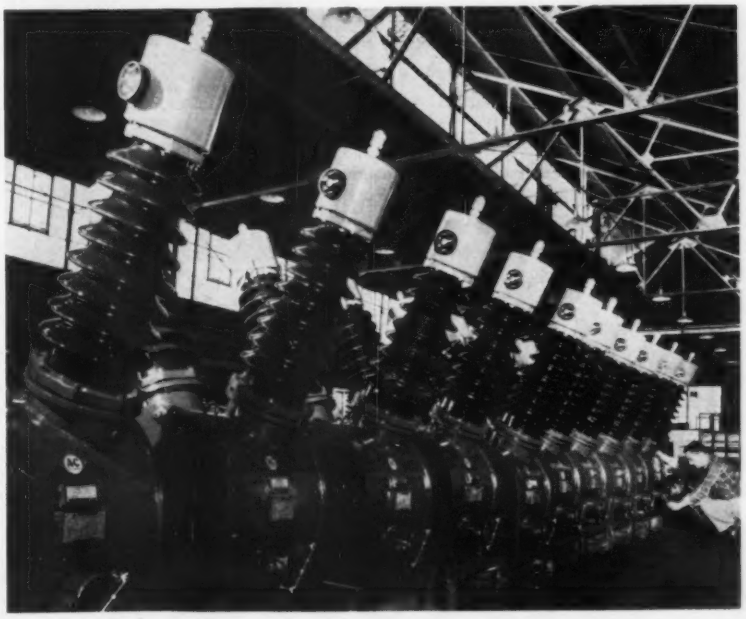
Upon development of these secondary capacitors (EW, Nov. 4, 1957, p 104) a production line was established, and now volume is reportedly accelerated to fill the orders from electric utilities.

So Cal Edison Gets A-C Transformers

These 69-kv outdoor potential transformers, having their final inspection at Allis-Chalmers Pittsburgh Works, are destined for the transmission lines of the Southern California Edison Co. The hermetically sealed, oil-filled units will step down transmission or distribution voltages to 115-v for the operation of measuring instruments and relays in the California utility's system.

These potential transformers operate reportedly at better than 0.3% accuracy. Industry demand for these transformers is said to be on the upgrade.

(*More Manufacturers News on p* 96)



VERSATILITY sells
CADWELD
electrical connections

CADWELD electrical connections have 5 basic outstanding features:

1. Permanent — cannot loosen or corrode.
2. 100% current carrying capacity.
3. Compact — easily installed.
4. Light weight equipment.
5. Portable equipment — requires no outside source of power or heat.

BESIDES THESE FEATURES IS A SIXTH MAJOR POINT THAT OUTSELLS ALL FIVE — *VERSATILITY*

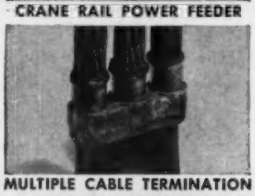
Once any customer has made a CADWELD electrical connection he knows the process. From that point, the only change is in the individual mold design. Todays catalog, lists over 58 basic types of connections — one year ago, there were only 32. The specials have become standards, because our customers approve the high quality of CADWELD and request it on new applications every day.

Send in your special electrical connection, it will be a standard CADWELD connection tomorrow.

TUBULAR BUS TERMINATION

MULTIPLE TAP CABLE TEE

CRANE RAIL POWER FEEDER


MULTIPLE CABLE TERMINATION

BUS BAR ELL

CONDUCTOR TRANSITION JOINT

CADWELD®

Erico Products, Inc.

2070 E. 61st Place Cleveland 3, Ohio

IN CANADA: ERICO INCORPORATED, 3571 Dundas St., West, Toronto 9, Ontario

Aluminum-Covered Wire Developed by Copperweld

Alumoweld, an aluminum-covered steel rod which can be redrawn into wire, is a recent research product of Copperweld Steel Co, Glassport, Pa. It was developed in conjunction with Battelle Memorial Institute.

This product is expected to lend itself to many applications of aluminum-type conductors, according to the manufacturer. And, it should have interest for many present users of copper-covered steel wire and strand.

A pilot plant is in operation, but it is expected to be converted from an experimental line to a limited production line in about a month.

Series-Multiple Switches Come on Transformers

Moloney Electric Co, St. Louis, is marketing transformers from 5 to 167 kva arranged for series-multiple operation on the high-voltage side. These are equipped with an externally operated series-multiple switch by which the change from multiple to series connection can be made quickly and easily.

The company reports this type of transformer is applicable in areas where the utilities are planning to increase the distribution voltage to handle the increased load on their system.

It is available in standard sizes from 5 to 167 kva with any of the following voltage ratings: 2400/4160Y × 4800/8320Y; 2400/4160Y × 7200/12470Y; 4800/8320Y × 14400/24940 grd Y; 7200/12470Y × 14400/24940 grd Y.

Roebling Operates 600-lb Capacity Banbury Mixer

Recently installed Banbury mixing and blending equipment is now in operation at the Electrical Wire and Cable Division of John A. Roebling's Sons Corp, Trenton, N. J. Installation cost was almost $500,000.

This motor-driven equipment increases production capacity and improves the quality of cable insula-

(*Continued on page* 98)

This wooden pole had a normal life expectancy of 25 years—grass fire reduced it to less than five. Even where one fire doesn't make a pole a total loss, pole life is substantially shortened. One application of economical, easy-to-use "Telvar" would have prevented this costly and unnecessary damage.

Kill fire-hazardous vegetation all season long— spray just once with Du Pont "TELVAR"

Chemical pole scalping with "Telvar" eliminates fire-hazardous vegetation and offers a considerable saving over expensive hand-scalping methods.

"Telvar" kills vegetation through the roots and prevents regrowth because the chemical remains in the soil to provide residual action all season long. Low dosages (1 to 1½ lbs. per 1,000 sq. ft.) make it cost little for the results obtained. Such low rates also cut storage and handling costs.

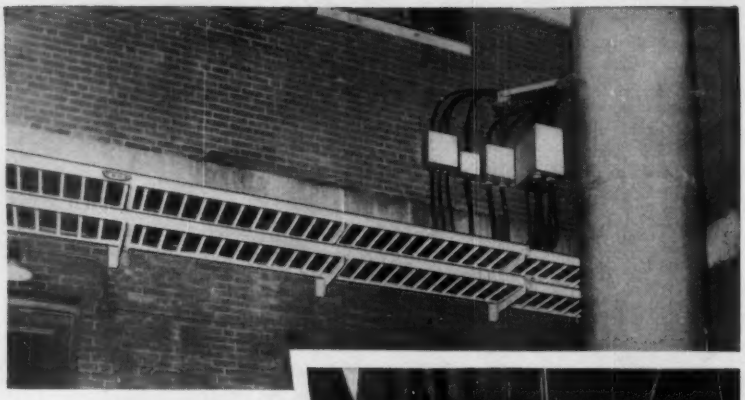
"Telvar" weed killers come as wettable powders, are non-corrosive, non-flammable, non-volatile, low in toxicity to humans and livestock. Wherever vegetation creates a fire hazard or makes maintenance difficult, such as pole yards, storage areas and substations, use Du Pont "Telvar." Write Du Pont, Grasselli Chemicals Department, Room D-4032, Wilmington 98, Delaware, for illustrative booklets on "Telvar" for long-term, low-cost weed control.

On all chemicals always follow label instructions and warnings carefully

DU PONT
REG. U. S. PAT. OFF.
BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

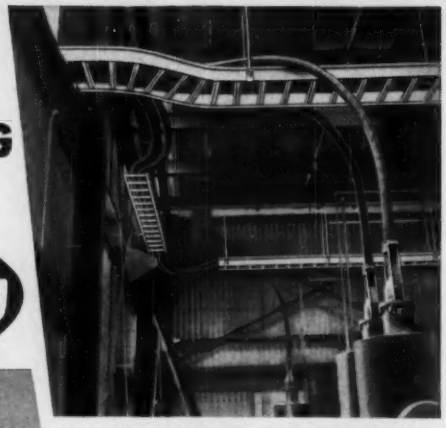
TELVAR®

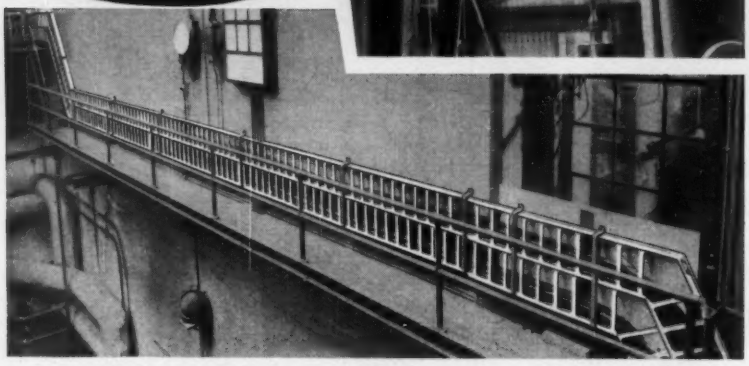
MONURON AND DIURON WEED KILLERS



a new, superior system of CABLE and TUBING RACE WAYS...

Globetray PAT. PENDING





A completely engineered system of cable ways, production produced and die formed for uniformity with up to twice the strength of ordinary trays, by actual laboratory tests. The universal splice plate joins all parts through the side channels only. All curved fittings are joined at the end of the radius (no tangent material is required) permitting continuous curves. This feature provides greater flexibility of application in tight places and creates an endless variety of combinations for a simple solution to any design problem of change of direction or elevation with a complete set of standard fittings.

Comes in 6", 12", 18" and 24" widths, in standard 12' lengths to further speed up installation time. Cable way can be cut to length at any point—insides and bottom always smooth—all sections punched for easy installation—perfect fit at all times. Neat, clean and uniform in appearance.

Globetray THE GLOBE COMPANY

EASY TO INSTALL • SAVES TIME • SAVES ON MATERIAL
GALVANIZED • NO MAINTENANCE PROBLEM

Write for new complete catalog. Distributors in all principal cities. Contact the Grip-Strut distributor under "Conduits" in the classified telephone directory.

PRODUCTS DIVISION The GLOBE Company

4030 S. PRINCETON AVE. • CHICAGO 9, ILL.

Roebling Mixer *(cont'd)*

tion. It can prepare up to 600 lb of rubber cable insulation at one time, thereby permitting a considerable saving over previous production time requirements.

Modern features of the new Banbury mixer include an automatic feeding system and a conveyor system for cooling the rubber.

Type UD Transformer Data Given in Uptegraff Bulletin

The Type UD line of pole-type distribution transformers is produced by R. E. Uptegraff Mfg. Co, Scottdale, Pa. These single-phase Class OA transformers in ratings 3-167 kva, 15 kv and less, reportedly feature reduction as much as 20% in height and weight.

Bulletin No. 135-A presents description and data on electrical and mechanical characteristics, standard tap ratings, bushing terminal sizes and other factors.

Steam Expansion Joints Have SS Bellows Elements

Badger Mfg Co, Cambridge, Mass., recently introduced a line of expansion joints which are offered for low, intermediate and high steam pressures. They incorporate the new Curvilinear Corrugation and tubular reinforcing ring design made for high pressure service.

Bellows elements of the Badger joints are fabricated of stainless steel; the remainder of the joint is carbon steel. This combination is satisfactory for service where temperatures remain consistently below the 750F mark. The joints are employed in many crossover assemblies in General Electric turbines.

U. S. Copper Production

Primary copper production in U.S. for February amounted to 87,150 tons as compared to the 94,735 tons reported for January, according to the Copper Institute,

(Continued on page 100)

NEOPRENE...POLYETHYLENE...VWP*

Self Supporting Service Cable

Southwire...a name synonymous with service...offers a complete range of self supporting service drops to meet every possible need.

AAC...ACSR...or Copper. In every combination to customer specifications. All are manufactured, from start to finish, in our own modern plant.

Southwire Neoprene, Polyethylene, or VWP*(Vinyl) are especially designed for low-voltage installations. Every service drop meets or exceeds ASTM specification.

Whatever your requirements, specify Southwire and get the fastest, most reliable delivery possible—by our own trucks—to your warehouse or jobsite.

SOUTHWIRE PRODUCTS

- Bare and Weatherproof Copper and Aluminum Line Wire
- Neoprene, Polyethylene, and VWP*(Vinyl) Weatherproof Copper, Aluminum and Triplex
- U.R.C. (DBWP, TBWP) Copper
- Copperweld® Conductors
- Copper and Aluminum Building Wire
- ACSR and All Aluminum Cable
- Galvanized Steel Guy Strand and Static Wire
- Aluminized Steel Guy Strand and Static Wire
- Aluminum Alloy Wire
- Cable Accessories
- ALSO FABRICATORS OF COPPER AND ALUMINUM FOR WIRE AND CABLE MANUFACTURERS

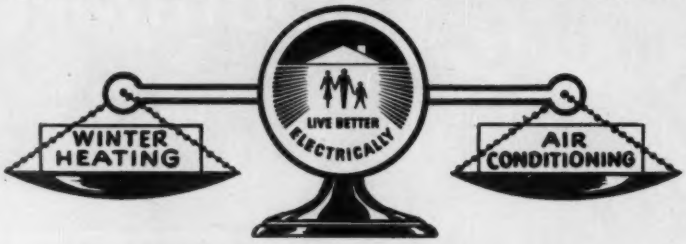
Southwire® Company

TErrace 2-6311 CARROLLTON, GEORGIA

BUILD YOUR WINTER LOAD
with ELECTROMODE

ELECTROMODE All-Electric HEATERS

The perfect BALANCE for your Summer Air Conditioning Demands

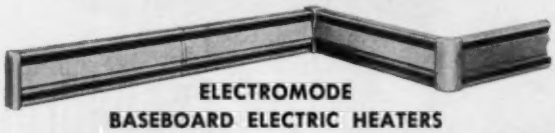


EVERYWHERE, more and more people are LIVING BETTER ELECTRICALLY

and Electromode is ready with the World's *Safest* and most complete line of All-Electric Heaters, to help utilities stabilize their loads on a year 'round basis.

More than 100 Models, specifically designed for the needs of

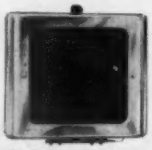
HOME • FARM • INDUSTRY



ELECTROMODE
BASEBOARD ELECTRIC HEATERS

WALL-TYPE FAN-CIRCULATING HEATERS

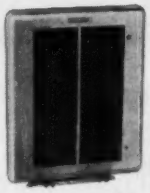
For All Size Rooms



Bathroom Heaters

Also made in Portable models, modern designs, and capacities for large and small rooms.

Other Electromode HOME Heaters: Radiant Cable Heat and Radiant Convection Panel Heaters



Down-Flo Heater for Big Rooms

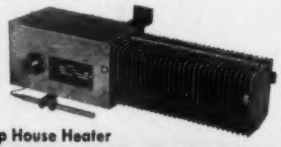
Suspension-Type Heater

FOR INDUSTRY

Electromode Heaters are made in Suspension-Type, and Combination Portable and Suspension Heaters, as well as Explosion-Proof Heaters, specifically designed and approved for use in hazardous areas.

ALL AROUND THE FARM

Milk House Heater



Pump House Heater

Why Electromode is SAFEST!

because only Electromode has the Safety Grid, a completely sealed-in cast-aluminum heating element. No exposed hot wires or glowing coils. No danger of fire, shock or burn. Automatic safety switch prevents overheating.

ELECTROMODE
Division Of
COMMERCIAL CONTROLS CORPORATION

Get Complete Information From
Dept. EW-48 570 Culver Road
Rochester 3, New York

Copper (*cont'd*)

New York. Refined copper production also showed a decrease, 128,299 tons in February as against 136,748 tons in January. Deliveries to fabricators in February totalled 93,784 tons, down from 110,557 tons in January. Refined copper stocks, however, showed an increase—total was 201,223 tons for February and 176,287 tons for January.

Cover Diagram Included in Brush Control Service

R/W Maintenance Service, Buffalo, N. Y. has an R/W cover type diagram for its brush control service. The diagrams are maintained daily by the R/W foreman.

Following information is recorded: Location of brush on line; types of undesirable species sprayed; types of desirable species left as cover; location of roads; location of structures and distance between structures; location of streams, fences, railroads, swamps and houses on or near right-of-ways; width of right-of-way between structures and density of brush; total number of brush acres on line; and any unsafe or damaged condition of pole, wire, insulators, crossarms, etc.

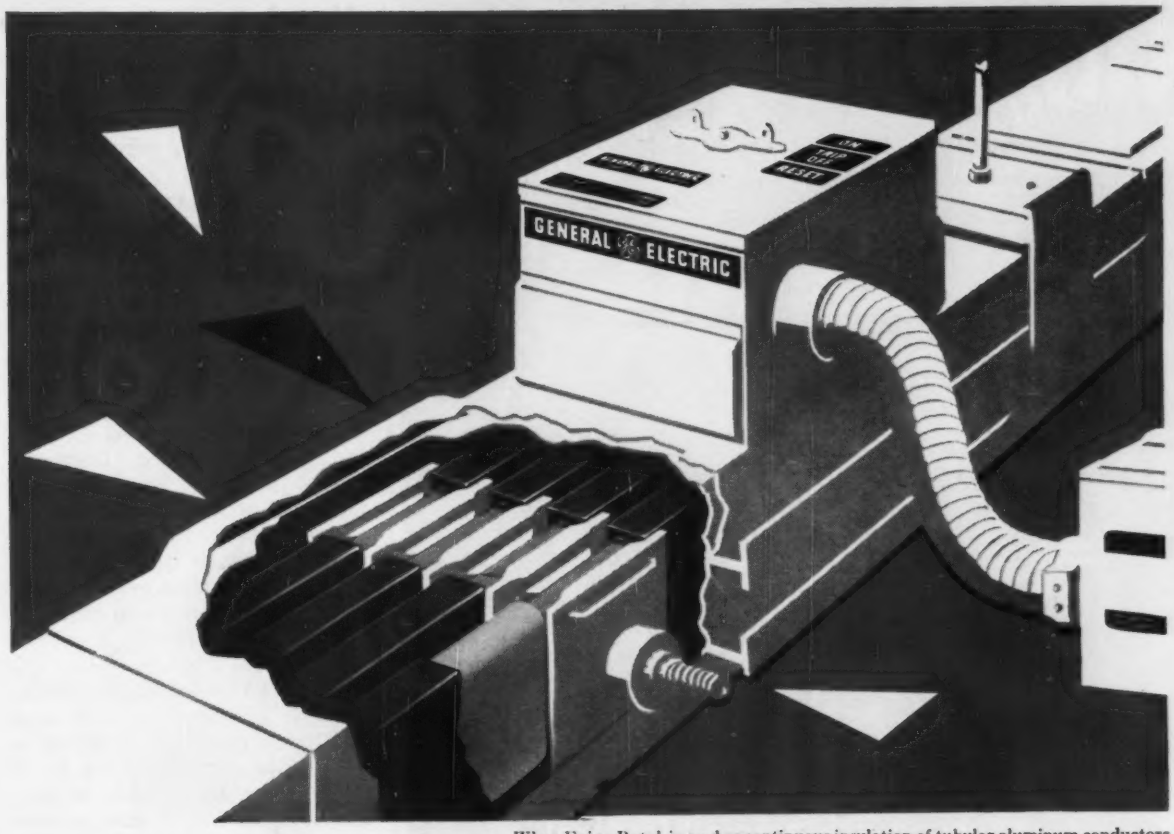
U. S. Aluminum Production

Primary aluminum production in U.S. during February totalled 121,602 tons, according to the Aluminum Association, New York. This amount is a decrease of 18,307 tons from January but an increase of 2,543 tons over February, 1957. Total aluminum production for the year through February was 261,511 tons, as compared to 266,089 tons for the same 1957 period.

MANUFACTURERS BRIEFS

Bituminous Coal Research Inc, Pittsburgh, Pa., has developed an Easy-Flo Bin to provide reliable flow of coal from bins and silos

(*Continued on page* 106)



When Enjay Butyl is used as continuous insulation of tubular aluminum conductors, traveling arcs are virtually eliminated, plug outlets are essentially dead-front.

ENJAY BUTYL

helps keep costs low in new Aluminum Busway!

Enjay Butyl is extruded over the full length of the conductors used in General Electric's new Type DE Busway, the first busway designed specifically for aluminum. This new busway incorporates all 22 features that engineers consider important in busway design, yet it is up to 30% smaller and 50% lighter than other busways of comparable rating.

Enjay Butyl rubber is ideal for use as continuous insulation of tubular conductors because of its inherent resistance to ozone and to heat aging. Add Butyl's excellent electrical properties, its vulcanizability and the fact that it is the *lowest cost* rubber on the market—and you'll understand why it was chosen above all other rubbers to do this job.

Every day manufacturers are discovering new ways to use economical Butyl. Find out how Enjay Butyl rubber can cut production costs for you. For further information and expert technical assistance, contact the Enjay Company.

ENJAY BUTYL

Enjay Butyl is the greatest rubber value in the world. It's the super-durable rubber with *outstanding* resistance to aging • abrasion • tear • chipping • cracking • ozone and corona • chemicals • gases • heat • cold • sunlight • moisture.

ENJAY *Pioneer in Petrochemicals*

ENJAY COMPANY, INC., 15 West 51st Street, New York 19, N. Y.

Akron • Boston • Charlotte • Chicago • Detroit • Los Angeles • New Orleans • Tulsa

BERMICO® electrical conduit used at Norfolk Naval Air Station...

because it meets all Federal specifications for fibre conduit to be encased in 3½" of concrete

Above installation by E. C. Ernst, Inc.

Sixty miles of Bermico Conduit carry power lines of up to 34,000 volts as well as signal lines for communications and supervisory systems at the U.S. Naval Air Station, Norfolk, Va.

Precision engineered Bermico Conduit is made to exacting specifications from cellulose impregnated with pitch. It is strong, light, low-cost, and highly resistant to acids and alkalis. Completely uniform, it installs quickly and easily.

Bermico Conduit is specified by leading electrical contractors and by public utilities from coast to coast. To speed your cable installations . . . specify Bermico Conduit. Immediate shipment of all sizes and fittings guaranteed.

Distributed by WESTINGHOUSE Electrical Supply Company
Offices in principal cities

BROWN COMPANY
Berlin, New Hampshire
General Sales Offices: 150 Causeway Street, Boston 14, Mass.

Manufacturers Briefs (*cont'd*)

without arching, rat-holing or funneling. Fairmont Machinery Co, Fairmont, W. Va., has been licensed to manufacture and sell this device.

National Fire Protective Assn, Boston, has released three official interpretations of the 1956 National Electrical Code. Subjects covered are, clearance of service drops, current limiting devices and single-pole circuit breakers as disconnecting means.

Goshen Rubber Co Inc, Goshen, Ind., has developed Gorbound process to bond rubber elements, fabricated of natural synthetic and silicone rubber compounds, to metals of various types, as well as to plastics, including nylon. It also allows rubber bonding to metal inserts and other items.

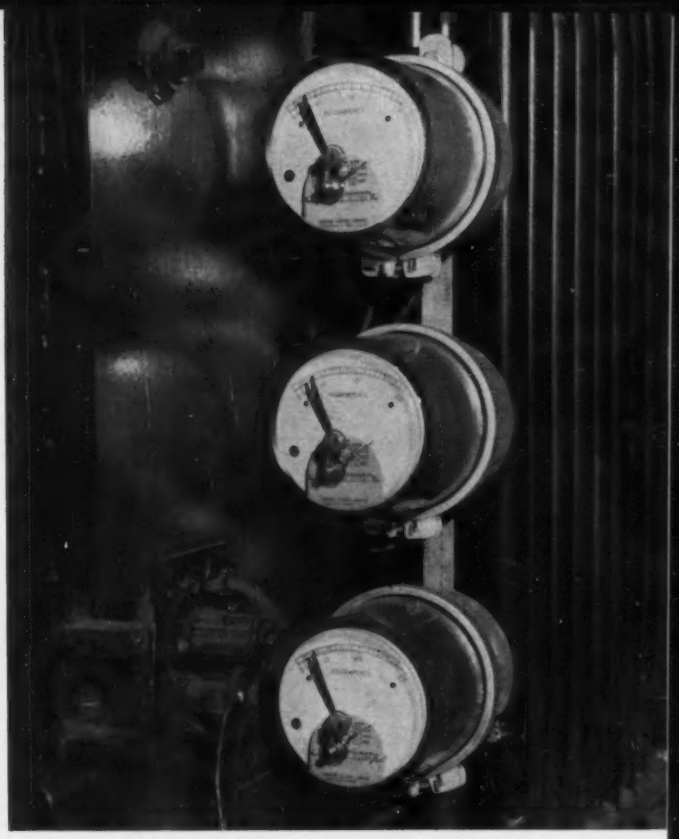
International Nickel Co of Canada, Toronto, has developed a process for the electrorefining of nickel, a main feature of which is the direct electrolysis of nickel matte, an artificial sulphide. The new process eliminates high-temperature oxidation and reduction operations, with attendant losses of metals, sulphur and selenium.

Secon Metals Corp, White Plains, N. Y., has produced two types of high-temperature magnet wire. One has a specially bonded refractory insulation, rated at 700F for continuous use and 800F for intermittent use; the other has a ceramic insulation rated for continuous use at 1000F.

Hoskins Mfg Co, Detroit, has a new series of iron-chromium-aluminum electrical resistance alloy, known as No. 875, for use as heating elements in industrial furnaces, kilns, and other equipment where continuous operating temperatures up to 2350F are required.

B. F. Goodrich Chemical Co, Cleveland, has introduced first nitrile rubber to resist ozone cracking. This quality, plus oil resistance, good flexibility, high strength, and exceptional resistance to abrasion and oxidation, suggests several applications, including electrical insulation.

Want low-cost accurate measurement of network system loads?



Lincoln Type AD-6 thermally lagged ampere demand meters indicate loading of transformer and show maximum demand reached.

NEW Sangamo Combination provides permanent installation for continuous demand measurement at a cost of $31.35 per phase*

Now you can obtain continuous measurement of loading of network transformers with the simple, inexpensive installation of Lincoln Type CC split-core Transformers and AD-6 ampere demand Meters. The CC Transformer consists of two identical "C" shaped wound cores, which bolt together around the bushing of your network protector—without service interruption. They connect to adjacent meter sockets. When AD-6 Meters are plugged into these sockets they continuously measure the loading of the transformer and leave an indication of the maximum demand reached. When a more detailed study of loading conditions is required the AD-6 meter can be temporarily replaced with a portable graphic ampere demand meter (Lincoln Type CCA-6) which charts a continuous record of demand. Ask your Sangamo representative, or write for information.

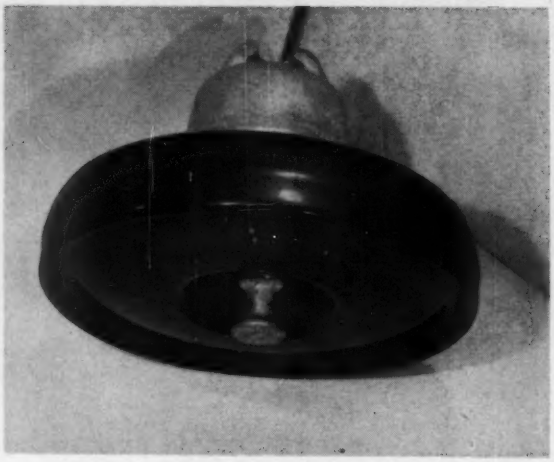
These Lincoln Type CC split-core Transformers, bolted together around the bushings or cables of a network protector, are connected to adjacent meter sockets. Available in ratings of 1500, 2000, 2500 and 3000 amperes.

*Cost of CC Transformer and AD-6 Meter.

SM57-6

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS



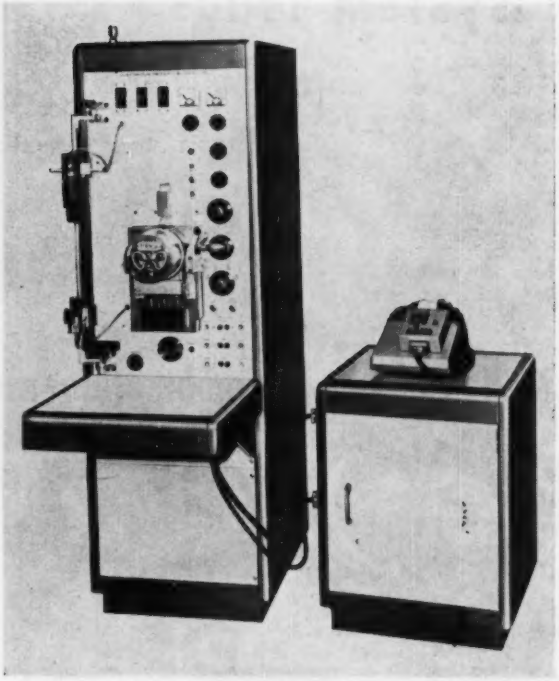
Suspension Insulator . . .

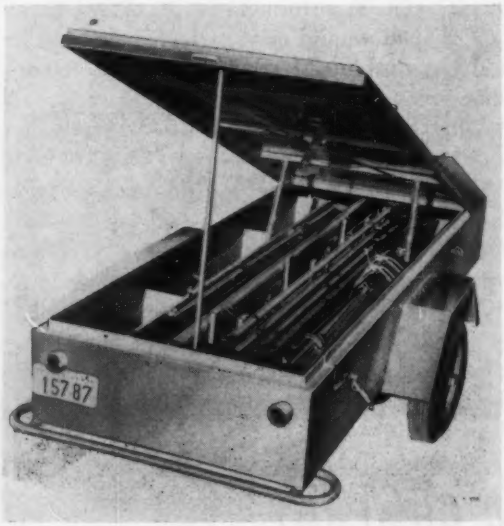
. . . for contaminated atmospheres has trapped air space, within insulator bowl, to reduce exposed insulator area and contamination. Striking distance and leakage distance are balanced to maximize service. Shell is ceramically welded one-piece unit. Unit is supplied with malleable iron or forged steel caps and forged steel ball bolts; special steel alloys are also available. Designated No. 961 Fogbowl, the unit can be used in vertical construction in fog, smog, salt spray, or sandy areas. **Victor Insulators Div, I-T-E Circuit Breaker Co, Victor, N. Y.**

Watthour Meter Calibrator . . .

. . . requires only one revolution for full load, 50% p.f., and light load test. Total testing cycle is about 54 sec. Used with 1-phase 2-wire and 3-wire self-contained meters, it computes per cent registration by electronic pulse counting and automatically prints results in digital form on tape. Counter uses 1,000 pulses per revolution, providing accuracy of ± 1/10 of 1% in test results. Full load testing currents are 5, 10, 15, 25, 30 and 50 amp; corresponding light loads are 10% of these values. Pulse count is made with both meter and standard at stable speed and is started and stopped electronically.

Eastern Specialty Co, 3617 N. Eighth St, Philadelphia 40, Pa.



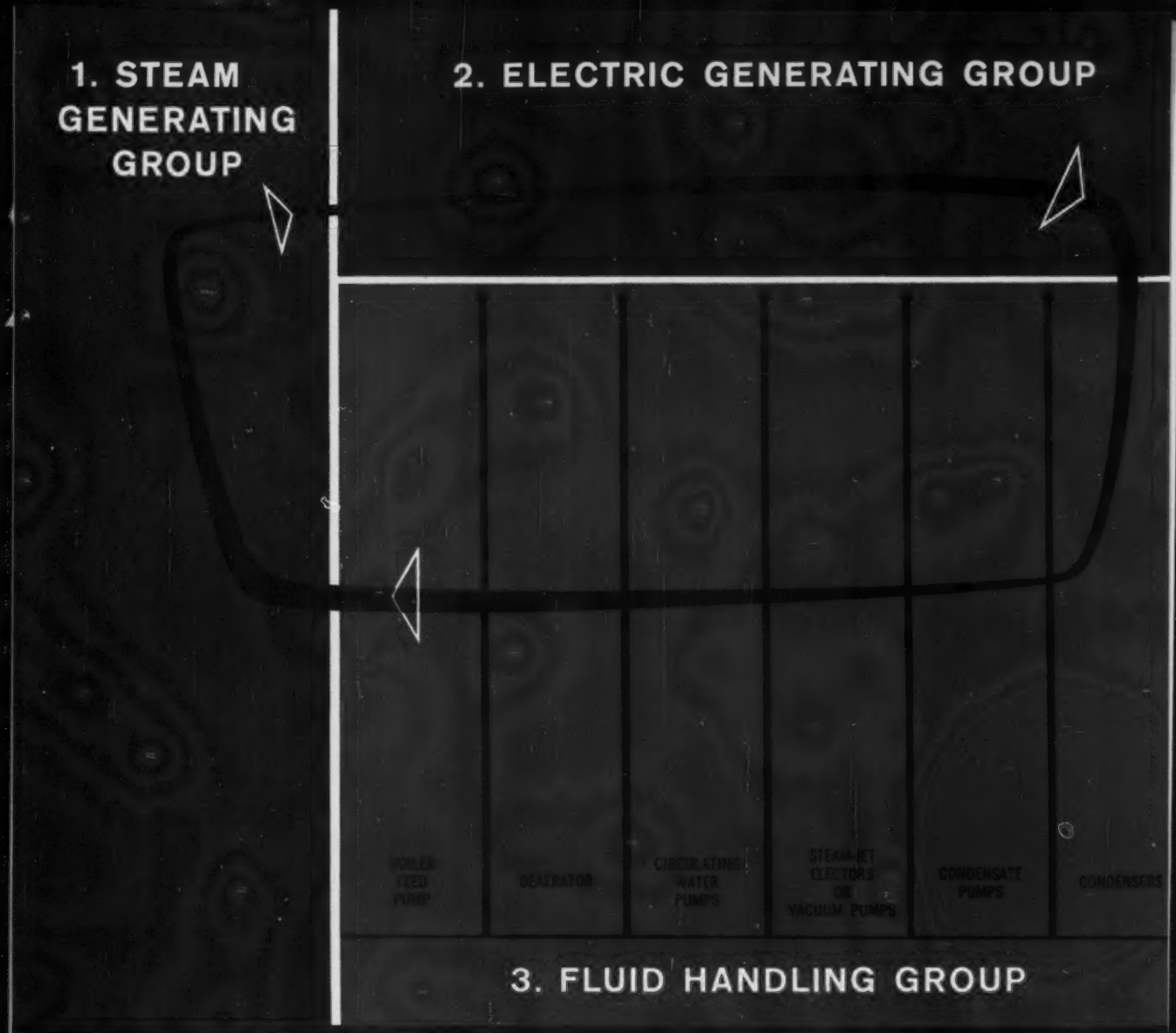


Hot Line Tool Trailer . . .

. . . weighing 900 lb carries enough tools for most straight-line tool jobs. Racks accommodate nine 12-ft sticks and ten 10-ft sticks, plus variety of medium and small sticks. Five bins carry conductor cover material and small equipment. This watertight trailer is equipped with heater and circulating fan. One-piece lid rises on compression springs and locks in open position.

A. B. Chance Co, Centralia, Mo

(*More New Equipment on page* 108)

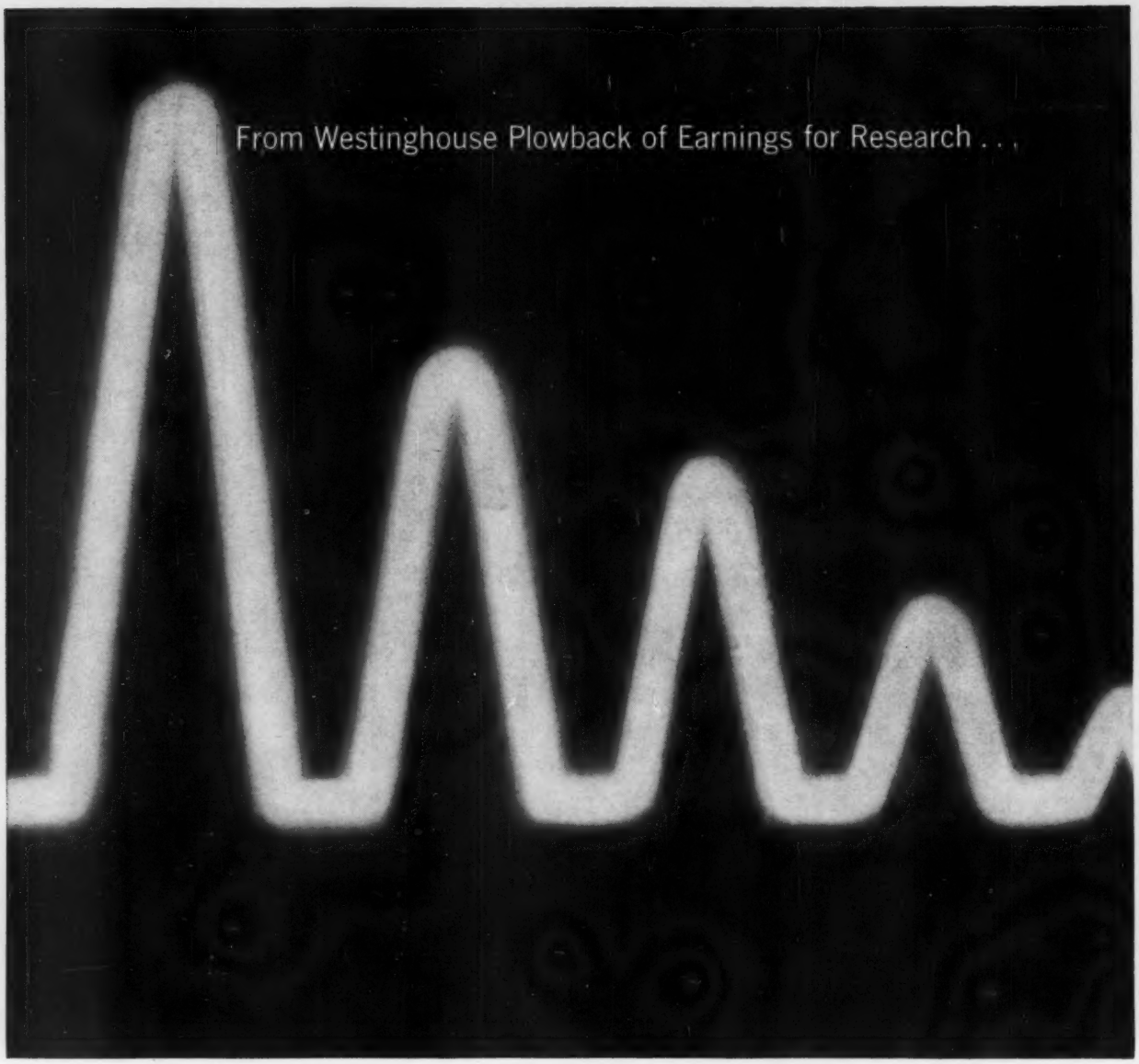


LOOK AT ALL THREE FOR POWER

THE FLUID HANDLING GROUP in a steam power plant has as many individual components as the other two combined. Failure of any one component can disrupt operation of the whole. Reliability can best be achieved through compatible integration of the wide range of equipment in this all-important group. As a manufacturer of all major fluid handling components, Worthington's "system-wise" experience and knowledge can be of extreme value to you. For information, write or call your nearest Worthington district office. Worthington Corporation, Harrison, New Jersey.

45-1

WORTHINGTON

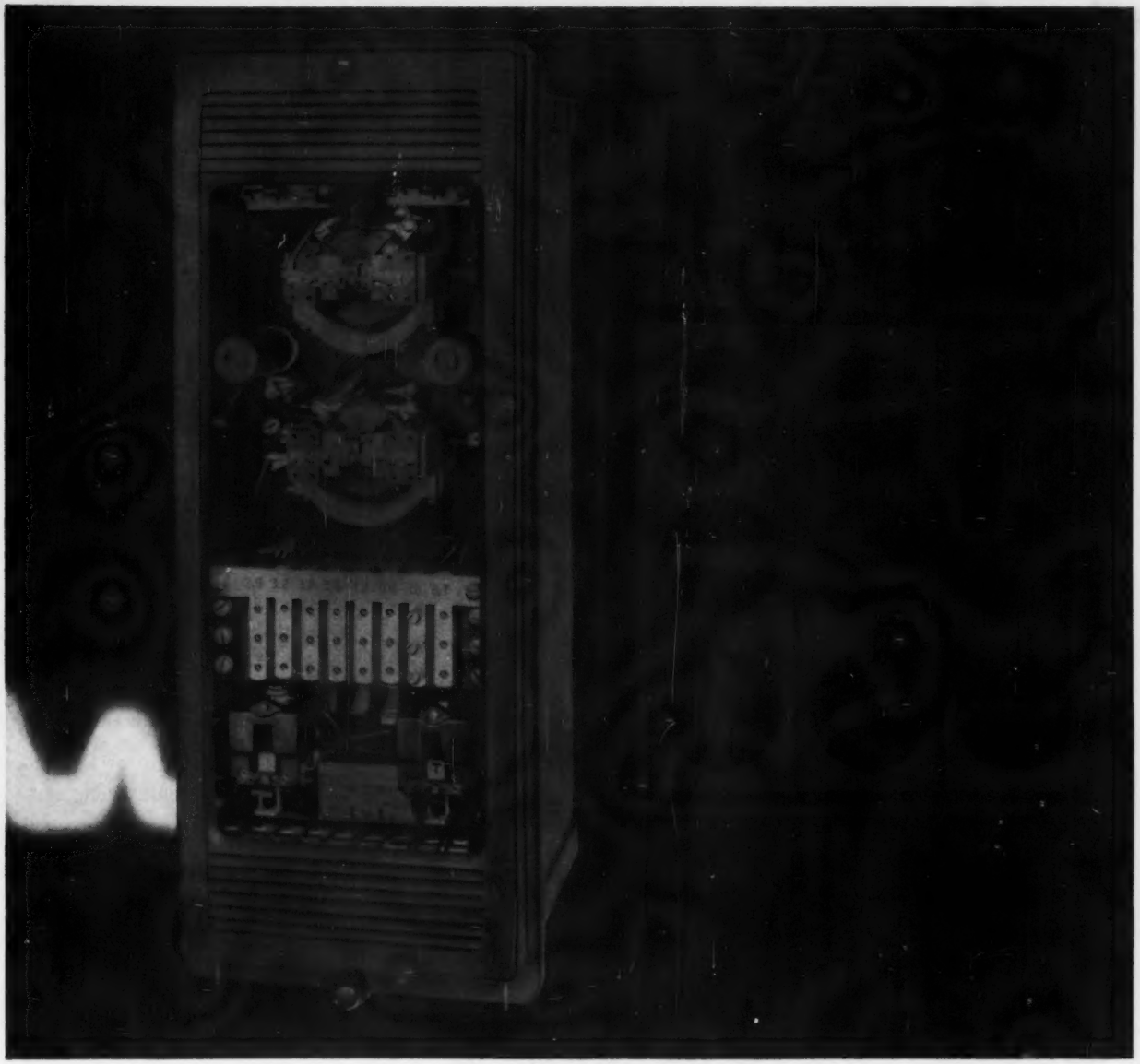


A new measure of high-speed *differential protection* for transformers

In the new Type HU variable percentage differential relay with second harmonic restraint supervision, Westinghouse now offers more complete and reliable protection than ever before available for two-or three-winding transformers.

Restraint supervision, on second harmonic only, prevents false trip-outs on inrush currents. The relay does not restrain on third harmonics, thus providing full protection against heavy internal faults. The variable percentage operating characteristic eliminates the need for sensitivity taps on the relay, yet provides sensitive detection of light internal faults and ample restraint for heavy external faults.

Two high-speed polar-type units in the HU relay provide simplified operation: (1) a differential unit to distinguish between internal or external faults; (2) a

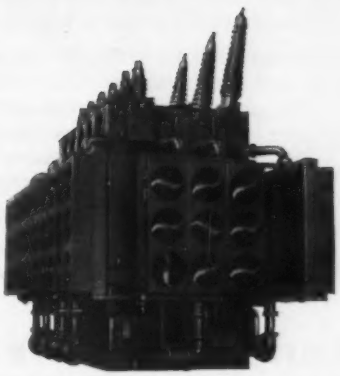


harmonic restraint supervising unit to distinguish between inrush and fault currents.

The harmonic differential units will operate in 1.5 to 2.5 cycles; and the instantaneous trip unit will operate in ¾ cycle for heavy internal faults. The relay has low burden, requiring about three volt-amperes at tap value current. Built-in ratio taps compensate for mismatch of line current transformers on both two-and three-winding applications.

Adequate transformer protection is also provided during reduced frequency operation, such as exists during the generator warm-up period.

For further details about HU relay transformer protection, call your Westinghouse sales engineer or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-40504



Type HU relay protects two-winding transformers; HU-1 for use with three-winding transformers.

YOU CAN BE SURE...IF IT'S

Westinghouse

For the long haul

guy with

CF&I GALVANIZED STEEL STRAND

Stringing lines over woodlands or difficult terrain is an expensive initial operation. But maintainance, too, can be costly unless the guy and messenger wires have the strength to withstand severe storms and the corrosion-resistance to assure long, trouble-free service.

To meet these requirements, CF&I carefully controls every step in drawing, galvanizing and stranding its Galvanized Steel Strand. Extreme care in cleaning and galvanizing produces a heavy, tightly-bonded coating of pure zinc that provides maximum protection against corrosion. CF&I Strand meets or exceeds ASTM Specifications A-122 or A-363, or can be made to meet customer specifications in seven- and three-wire constructions.

Your nearest Electrical Wholesaler or CF&I representative will give you full details. Call him today.

CF&I GALVANIZED STEEL STRAND
THE COLORADO FUEL AND IRON CORPORATION

5800

Albuquerque • Amarillo • Atlanta • Billings • Boise • Boston • Buffalo • Butte • Chicago • Denver • Detroit • El Paso Ft. Worth • Houston • Kansas City • Lincoln (Neb.) • Los Angeles • New Orleans • New York • Oakland • Oklahoma City Philadelphia • Phoenix • Portland • Pueblo • Salt Lake City • San Francisco • San Leandro • Seattle • Spokane • Wichita

Synchronous Generator . . .

. . . in ratings of 30 to 150 kw at 1,800 rpm and 50 to 300 kw at 1,200 rpm is redesigned to provide shorter, lighter, more compact machine. It is offered in single bearing units for internal combustion engines, close-coupled to SAE flanges, and in two bearing units for belt drives or direct connection. Unit has improved exciter and is equipped with oversize grease-lubricated ball bearings which eliminate need for oil filters and sight gages. Insulation may be Class A, Class B, or special materials for stability at high temperatures, abrasion resistance, and moisture protection.
Allis Chalmers Mfg Co, Milwaukee 1, Wis.

Compression Sleeves . . .

. . . for splicing copper conductor have full inside taper that relieves vibration stresses at sleeve extremities. Energized conductors are easily inserted into bore entrance with hot sticks and hydraulic tool. Bore is sprayed with conductive metal to maximize holding power and conductivity. Shortened length reduces number of compressions and speeds installation without sacrificing holding power. Unit has center stop to prevent over-insertion and is available in sizes from No. 8 to 4/0 strand.
James R. Kearney Corp, 4236 Clayton Ave, St. Louis 10, Mo.

Silicon Rectifiers . . .

. . . rated 100, 150, 200 and 300 kw for operation from various a-c supplies are available as either regulated or unregulated equipment. Single enclosure houses protective equipment, transformer, and rectifier. In addition, regulated units include saturable reactor and voltage regulator.

Sheet steel cubicle of Semitron units has hinged front doors and removable rear panels for easy access

(*Continued on page* 110)

The technician at the control panel of Victor's impulse generator shown above, is photographing steep front wave forms for detailed laboratory study.

Steep Front Wave Tests at *VICTOR* Help Make Better Insulators

By David E. Alexander, Chief Engineer
Victor Insulators Division, I-T-E Circuit Breaker Co.

"The high voltage impulse generator in the Victor electrical laboratory enables us to simulate the most severe conditions of service an insulator will ever experience in use. By photographing the various wave forms caused by high voltage discharges, we are able to study in detail and at length, their many characteristics and their effects on insulator design and construction.

For some time now, we have been delving into the little known realm of steep front wave forms. This research has already resulted in better, stronger high voltage insulators . . . points the way to even better insulators as our studies continue."

This is but one phase of Victor's broad continuous program of research in electricity, ceramics and manufacturing methods . . . a program that bolsters our contention that "you can't buy better insulators at any price!"

I-T-E CIRCUIT BREAKER COMPANY
VICTOR INSULATORS DIVISION
Victor, New York

Nelson
MOTOR CONTROL CENTERS
make it talk louder!

When all the costs are totaled up at the end of the job Nelson's ease of installation and compact design will let you beat the estimate.

And even that is not the whole story. Nelson's coordinated design, using components specially selected for long trouble-free service, means less maintenance cost down through the years. If saving money is important you will specify and buy Nelson motor control centers.

. . . . MONEY ISN'T EVERYTHING

Other things are also important. The people at Nelson are interested in seeing that you have the very best workmanship. Nelson engineers with their long experience in motor control will see that your job is built to do exactly what you want it to do. Cooperative team work is more than a phrase at Nelson.

. . . GET THE FULL STORY

Write for the descriptive brochure that gives you full details on Nelson motor control centers. Sizes, types, components, design features and sample specifications are all included.

NELSON ELECTRIC MANUFACTURING CO.
P. O. Box 5385 — Tulsa, Okla.
Please send me a free copy of your new Nelson Motor Control Center bulletin.

NAME_____

FIRM_____

ADDRESS_____

CITY_____

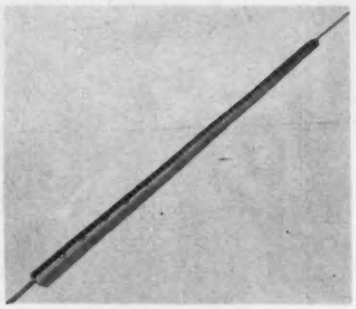
a major source of electrical control equipment for industry

NELSON *Electric* MANUFACTURING CO.
TULSA, OKLAHOMA

Silicon Rectifiers . . .

(*Continued from page* 108)

to components. High speed current limiting fuses are in series with each group of elements.
Westinghouse Electric Corp, P. O. Box 2099, Pittsburgh 30, Pa.



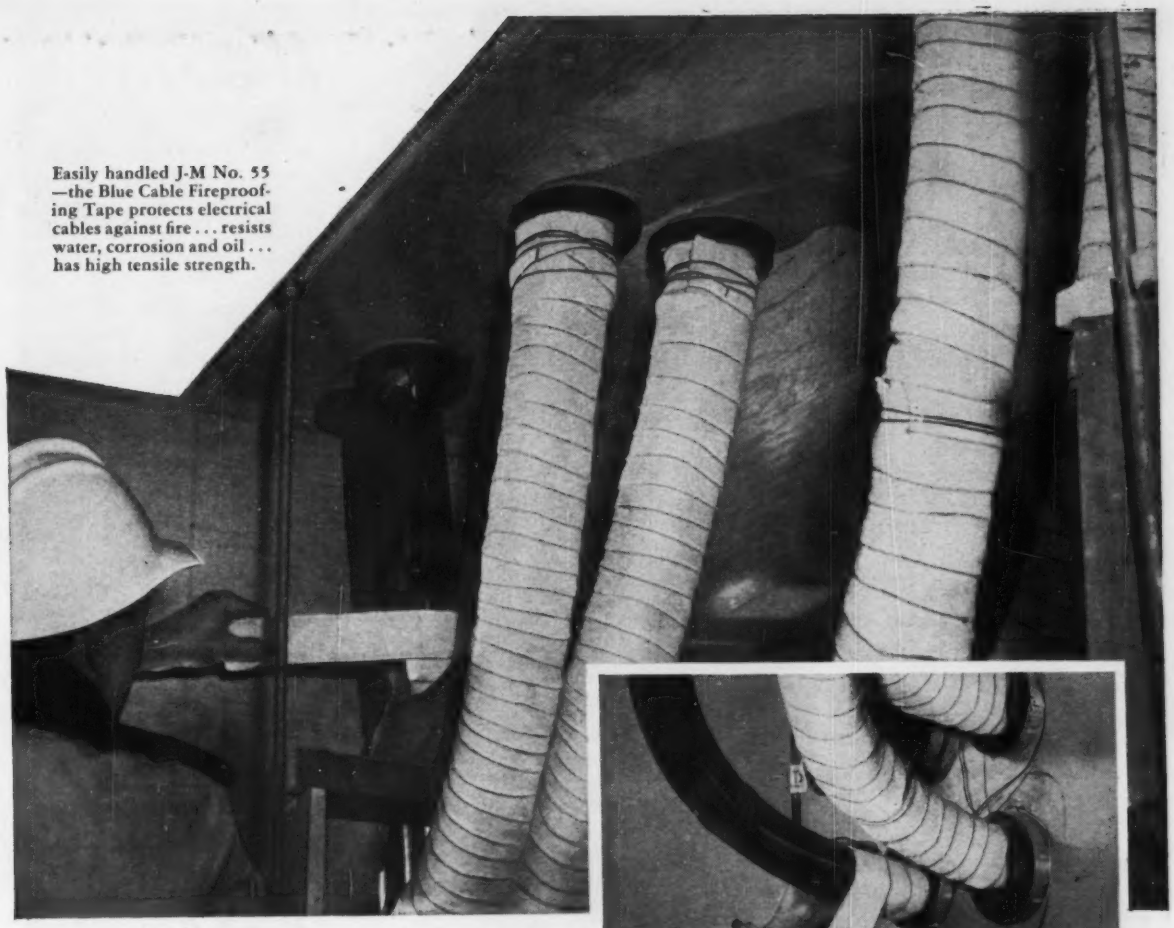
Tapered Guy Guide . . .

. . . has large cross section at lower end to effectively cover clamps and anchor rod eye. Edges of 18-gauge metal are rolled with large radius for rigidity and safety. Simple clamps secure guard to ¼ to ⅝-in. strand. Upper clamp may be fastened in either of two holes. Lower clamp positions in any of four holes for mounting through the strand loop. Both 7- and 8-ft lengths are available.
Joslyn Mfg & Supply Co, Chicago, Ill.

Aerial Lift . . .

. . . is insulated with fiber glass and counterbalanced to permit man to ride it safely while truck is moving. Unit mounts easily on open type standard service or utility body, and collapses low and short. Controls are located in basket and are simple to operate.
Truck Equipment Co, 3961 Walnut St, Denver, Colo.

(*More New Equipment on page* 112)



Easily handled J-M No. 55 —the Blue Cable Fireproofing Tape protects electrical cables against fire . . . resists water, corrosion and oil . . . has high tensile strength.

Photos courtesy of Lone Star Cement Co., Dallas, Texas

ELECTRICAL CABLES . . .

Fireproofed quickly . . . to last!

with J-M No. 55 Asbestos Cable Fireproofing Tape

Here is the effective, time-saving fireproofing for electrical cables . . . designed for lasting protection.

Made of asbestos, Johns-Manville No. 55 Cable Fireproofing Tape offers many outstanding advantages. It will not support combustion; repels water, resists flame, fungus, mold, corrosion and oil. Explosive or toxic gases will not develop under arc. High tensile strength is maintained even after burnout.

In addition, No. 55—the Blue Cable Fireproofing Tape is impregnated with a silicone material that provides low water absorption and high moisture repellence. Thus, damage from ground water, flooding, fog or humidity is minimized. Selvedged edges prevent threads from pulling out and weakening the tape. There are no ragged, unimpregnated edges through which ground water can penetrate.

J-M No. 55 Cable Fireproofing Tape is simple to apply, even in confined spaces. It won't droop, sag, or unravel . . . assures a tight, lasting wrap. Furnished in widths from 1" to 3" in 25- or 100-foot rolls, it is easy to handle and stock.

For complete information on J-M No. 55 Cable Fireproofing Tape, write to Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit, Ontario.

Johns-Manville ASBESTOS TEXTILES

JOHNS-MANVILLE JM PRODUCTS

The design work on all these new substations is going to be hard to handle with our present force.

Of course! They have enough to do handling routine duties. Why don't you call in PIONEER?

GIVE YOUR NON-ROUTINE OPERATIONS TO PIONEER

Design and Consulting Engineering Services

Pioneer has specialized in designing power plants for 56 years. It offers design service for fossil fuel, hydro and atomic plants. It will also assist in forecasting load growth, in site selection, in purchasing and expediting of equipment and in supervising construction. Pioneer's other services include substation, transmission and distribution studies and design.

Services in Regulatory Matters

Pioneer offers its services in all phases of Federal, State and Local regulation including the rate base, depreciation analysis, cost of service studies, market analysis, certificate proceedings and rate of return.

Corporate Services

Pioneer's services in corporate matters include business and management engineering advice, financial, accounting and tax counsel and insurance and pension plans and programming. It maintains a complete stock transfer, ledger and dividend disbursement service.

NEW! On your letterhead, write for 40-page booklet, "Pioneering New Horizons in Power". Describes, illustrates Pioneer's engineering services, and corporate services, from financing to operation.

56 YEARS

Pioneer Service & Engineering Co.

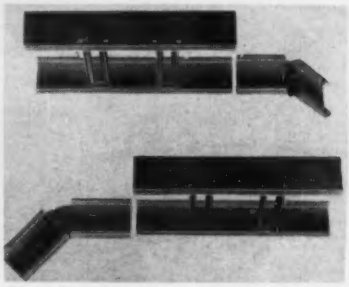
231 South La Salle Street
Chicago 4, Illinois

Dry-Type Transformers . . .

. . . with outputs from 6 to 2,000 kva are available in all standard sizes in 600-v, 5-kv, 8.66-kv, and 15-kv classes for power and lighting applications. Sound levels of these 3-phase transformers are within NEMA standards. Special models are available for locations requiring very low noise.

Wiring compartments are easily accessible through side panels and covers. Nameplate carries simplified wiring diagram; leads are marked for rapid identification. Bulletin 200 has complete data.

Hevi-Duty Electric Co, Milwaukee 1, Wis.



Adjustable Splice Plates . . .

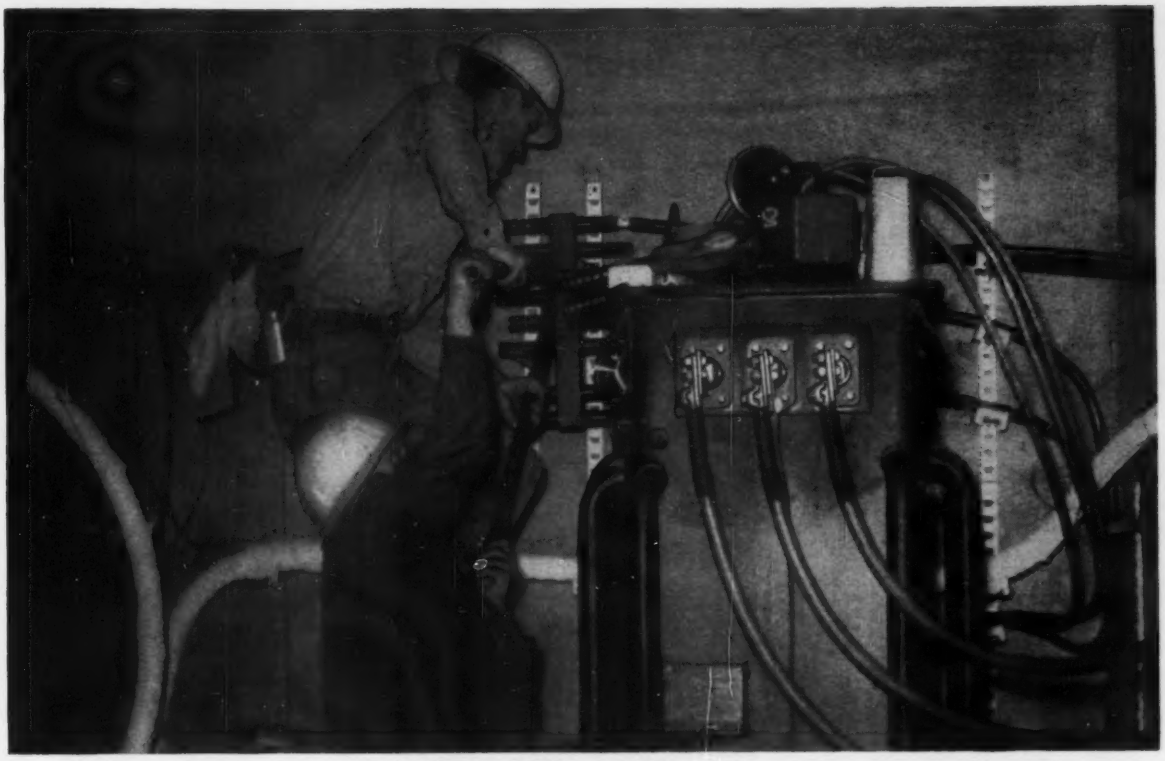
. . . for aluminum or steel cable support systems provide simple method of bypassing vertical or horizontal obstructions. Splice lock permits rapid, rigid, flush connections without necessity of cutting or drilling. Hinged pieces can be set and locked at angle required. Splice plates are available in aluminum, steel, or Type 2 Armco aluminized steel.

Chalfont Products Co, Inc, 11525 Madison Ave,, Cleveland 2, Ohio

Holding Furnace . . .

. . . for aluminum castings comes in four capacity sizes with capacities from 500 to 2,000 lb of aluminum. Compactness permits positioning very close to casting machine. Multiple tap transformer with wide range of output provides absolute temperature control. Resistance elements can be replaced while furnace is in operation. If furnace freezes due to power failure, charge can be easily melted out in less than

(*Continued on page* 116)



Cable crew gets ready to connect neoprene-jacketed cable to a "crab." Foreground: Neoprene cable connected to transformer secondary terminals.

FOR UNDERGROUND SERVICE

Southern California Edison finds neoprene-jacketed cable faster to install

Southern California Edison Company has several million feet of neoprene-jacketed cable in service in the Southern California area. The company initiated use of low-voltage cable covered with Du Pont neoprene in 1949 when they found that neoprene offered features not available in standard paper-insulated lead-covered cable.

Neoprene-jacketed cable makes installation faster for Southern California Edison. Reels of neoprene-jacketed cable are easier to handle, load out and rig for pulling. Neoprene cable pulls freely; make-ready time on the job site is shortened. Neoprene-jacketed cable can be spliced in a fraction of the time it took with lead-covered cable, and crews like the way it handles and splices.

Southern California Edison achieved substantial savings through the use of neoprene-jacketed cable, and they estimate that by 1960 they may be using a million feet of neoprene-jacketed cable annually.

This is another example of neoprene's accepted reliability, and ability to save time and costs. Of all resilient materials, only neoprene has balanced resistance to sunlight and weathering, oils and chemicals, heat, flex cracking, abrasion and cutting, oxidation and aging.

Ask your supplier about wire and cable jacketed with neoprene. It's available in single and multiple conductor types and voltage ratings to meet your requirements. Mail the coupon below to get the ELASTOMERS NOTEBOOK with actual on-the-job reports of neoprene's performance in a wide range of industrial products.

DU PONT

Better things for better living
. . . through chemistry

NEOPRENE
— made by Du Pont for 25 years

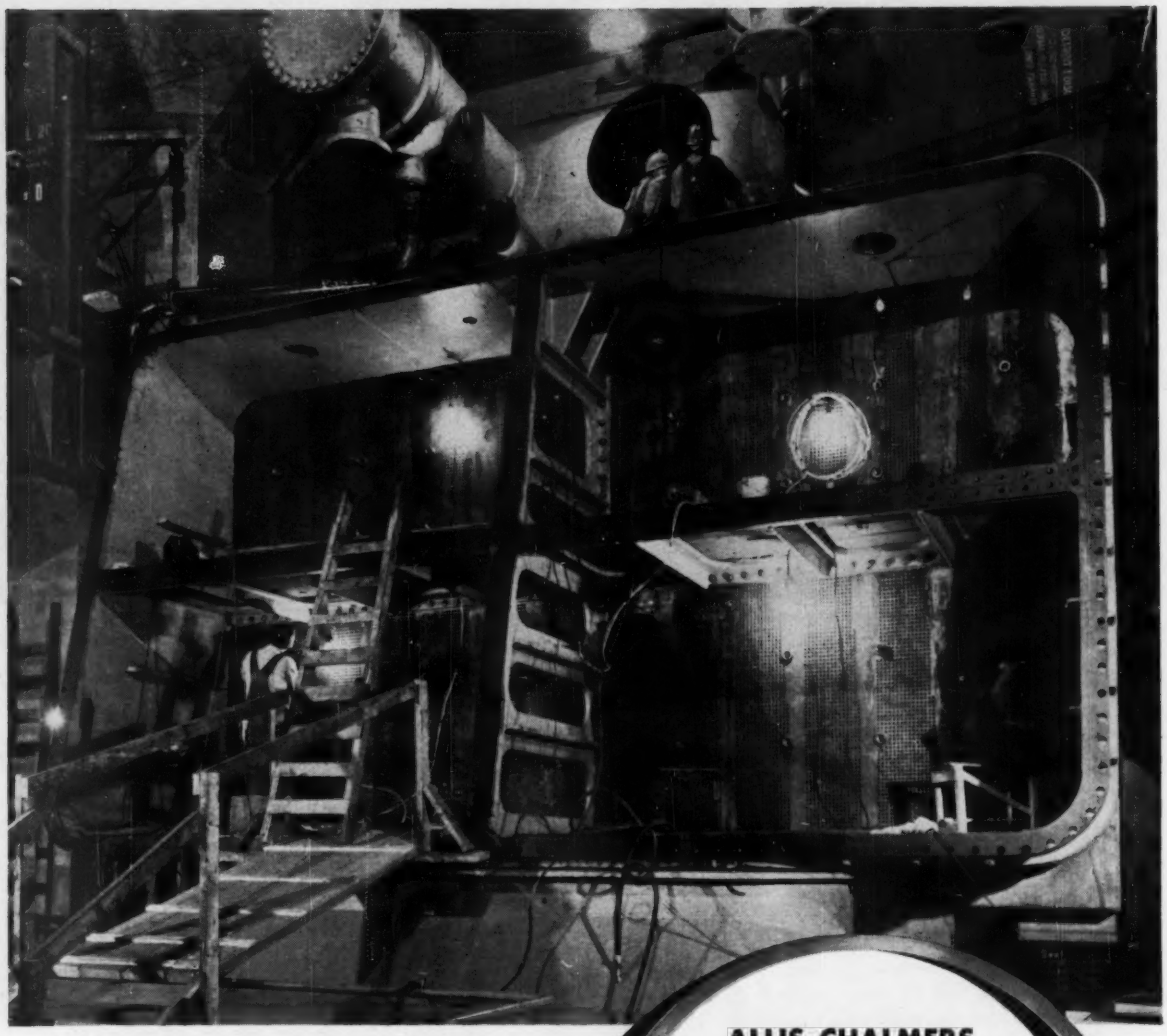
E. I. du Pont de Nemours & Co. (Inc.)
Elastomer Chemicals Dept. EW-4
Wilmington 98, Delaware

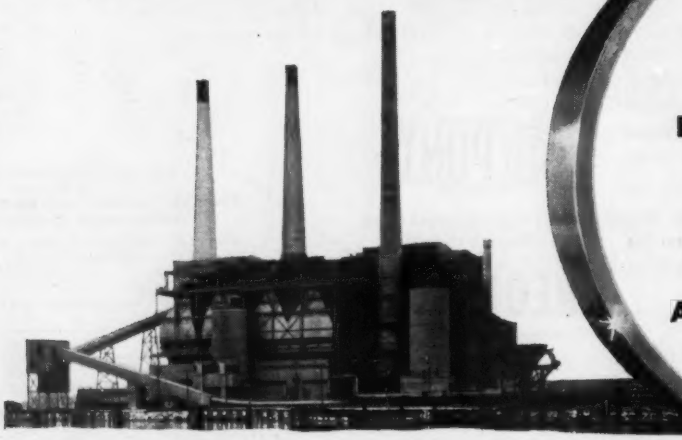
Please put my name on the mailing list for the Elastomers Notebook.

Name_____
Position_____
Firm_____
Address_____
City, State_____

MAIL THIS COUPON NOW . . . WHILE YOU'RE THINKING ABOUT IT

The bigger the condenser the





ALLIS-CHALMERS CONDENSER THAT WILL SERVE THE #2 UNIT, RIVER ROUGE STATION, DETROIT EDISON CO., CONTAINS 249,000 LBS. OF REVERE ARSENICAL ADMIRALTY CONDENSER TUBES

more it needs the dependability of

Revere Quality Tubes

When condensers get to be the size of this one made by ALLIS-CHALMERS (even bigger ones are now being constructed) owners can't afford the luxury of failure.

In order to leave nothing to chance, engineers of the Detroit Edison Company consulted with Revere Technical Advisors on the operating conditions under which the tubes would have to give service. Many different alloys were considered. The final decision was Revere Arsenical Admiralty Metal for the Tubes and Muntz Metal for the Tube Plates.

This final decision was based on a combination of the experience of Detroit Edison Engineers and Revere's wide experience in the condenser tube field, and the tremendous amount of research and laboratory work done in determining the relative corrosion resistance of the different alloys under a wide variety of operating conditions.

Since there are variable factors in practically every condenser tube installation, why not take advantage of this storehouse of facts and consult with Revere's Technical Advisory Service before making your tube commitments?

Revere furnishes plates, from the smallest to the largest sizes, in Cupro-Nickel, Copper, Herculoy, Muntz Metal, Naval Brass and Admiralty, and tubes in Cupro-Nickel, Aluminum Brass, Admiralty, Herculoy, Arsenical Copper, Muntz Metal and other alloys.

PLACING ONE OF THE 19,850 TUBES in the condenser for the new 265,000 KW turbine generator unit #2 at the River Rouge Station of DETROIT EDISON COMPANY. Tubes are ⅝" O.D. x 18 BWG x 30' long and are Revere Arsenical Admiralty Metal. Tube sheets are Revere Muntz Metal. A lasting combination!

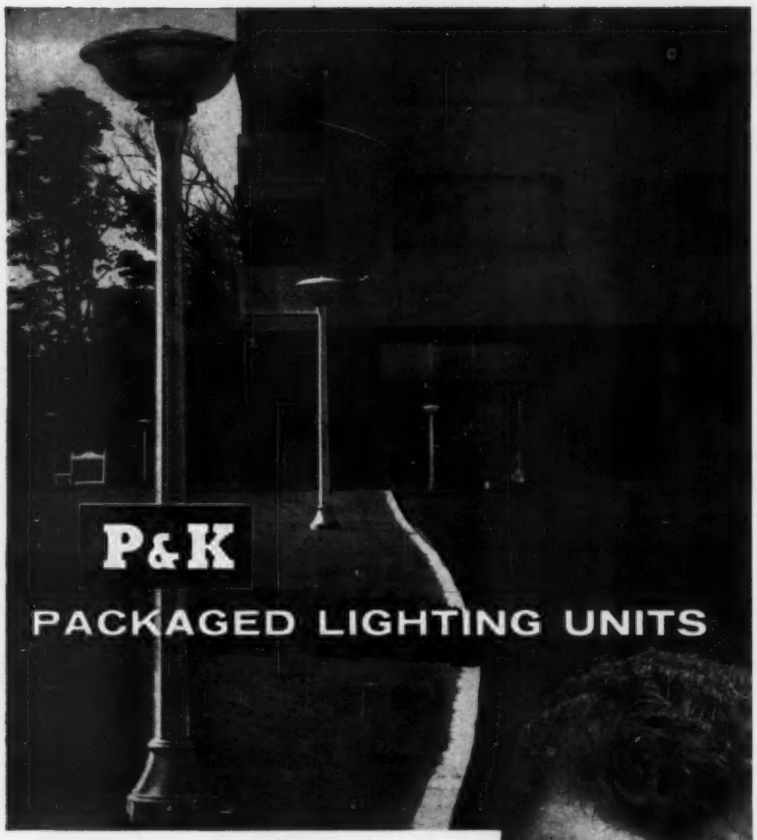
REVERE COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

Mills: Rome, N. Y.; Baltimore, Md.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Brooklyn, N. Y.; Newport, Ark.; Ft. Calhoun, Neb. Sales Offices in Principal Cities, Distributors Everywhere.

COPPER ★ BRASS ★ REVERE ★ ALUMINUM



make the job easier!

"When Harrison Park wanted to provide lighting for the grounds of their new luxury apartments—they chose P & K packaged units. Thus, from one source, they were able to select pedestal and lighting units, with such a wide choice in each, that they effectively customized their installation with standard components."

For example, you can choose from a wide range of conventional designs—davit or straight—as well as many more advanced shapes for any particular lighting requirement for residential, commercial, industrial and street lighting applications. Whatever you choose, P & K's seamless, tapered all-aluminum construction assures high strength, ease of installation, and virtually no maintenance. In addition, you also select the light source best suited to your needs — incandescent, fluorescent or mercury vapor.

HARRISON PARK CHOSE

the P & K package unit consisting of a CIRCLElux incandescent post top unit, and a slim, tapered ten-foot aluminum pedestal to achieve both the lighting they wanted and the beauty their handsome building required. For more information, write for catalog L-2.

P&K

PFAFF & KENDALL

84 FOUNDRY ST., NEWARK 5, NEW JERSEY

Holding Furnace . . .

(*Continued from page* 112)

24 hr. Unit operates on 220 or 440 v, 3-phase, depending on size. **Stroman Furnace & Engineering Co, 9900 Franklin Ave, Franklin Park, Ill.**

MORE NEW PRODUCTS

EWC series control station and pilot light **condulets** can be used indoors or out. Available in 1, 2 or 3 gangs as pushbutton stations, pilot lights and selector switches, they are designed for Class I, Groups C and D and Class II, Groups E, F, and G.—Crouse-Hinds Co, Wolf & Seventh North Sts, Syracuse, N. Y.

Mercury vapor **floodlights** for heavy duty are dust and moisture proof. Available in 10 in. size for 100 to 250-w lamps; 14, 16 and 18 in. housings for 400 to 1000-w lamps; and 20 and 23 in. for 700 and 1,000-w lamps. Bulletin No 640.—The Pyle-National Co, 1334 N. Kostner Ave, Chicago 51, Ill.

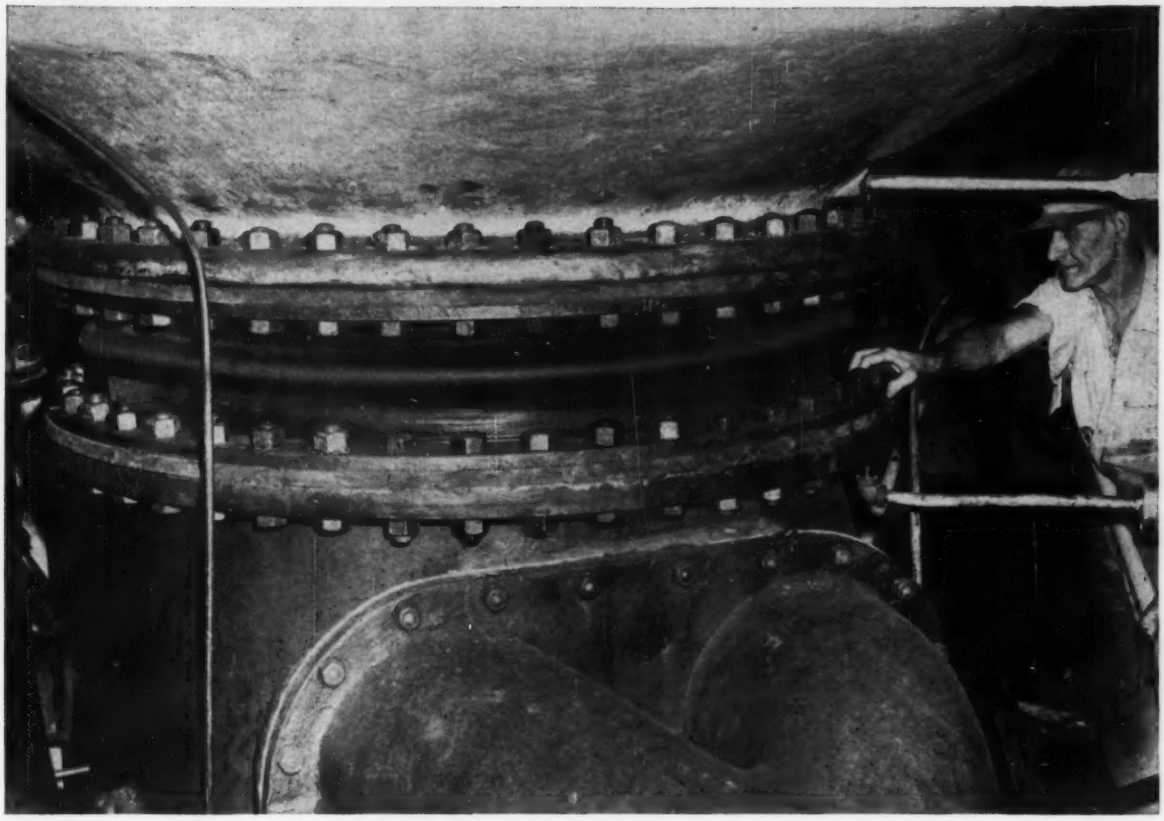
Model 23-1 2½ lb **fire extinguisher** spreads blanket of non-freeze, nontoxic, non-conducting dry chemical powder over 60-deg angle to a range of 12 ft. Operates at a pressure of 150 psi.—Fyr-Fyter Co, 221 Crane St, Dayton 3, Ohio.

Long scale **panel instruments** have good readability, self-shielding and good natural scale illumination. Models 1371 and 1375 are immune to stray fields and can be mounted on magnetic or non-magnetic panels. For high sensitivity requirements, Models 1373 and 1377 are available without outside magnet construction.—Weston Instruments Div, Daystrom Inc, Newark 12, N. J.

Dura-Stripe Teflon **insulated wire** has spiral stripes which are extruded as a permanent part of the insulation. Made in Type E for 600-v service or Type EE for 1000-v service at operating temperatures from —65C to +200C.—The Rex Corp, West Acton, Mass.

(*More New Products on page* 118)

US RUBBER EXPANSION JOINTS



For 34 years...

THE OLD JOINT THAT STAYED SUPPLE!

Just how long should a rubber expansion joint keep active? 15 years? 20? 25? Depending on the type of service, any one of these lifetimes would be old age by ordinary standards. But not for U. S. Rubber Expansion Joints.

For instance, the New York, New Haven & Hartford Railroad installed (at its Cos Cob, Conn., power station) one of the first U. S. Expansion Joints ever made. This was in 1924, the first year of Calvin Coolidge's administration. For 34 years, the U. S. Joint gave perfect service, required no maintenance.

When retirement time was finally decided upon, the joint was replaced, of course, by the new U. S. Expansion Joint shown above. Incorporating all the latest developments, this new joint is expected to give a performance worthy of its predecessor.

34 years on a job is just one of the many, many service records chalked up by U. S. Expansion Joints in power stations throughout the world. "U. S." was the first to make rubber expansion joints, and has always been the most reliable source of supply.

When you think of rubber, think of your "U. S." Distributor. He's your best on-the-spot source of technical aid, quick delivery and quality industrial rubber products.

NOTE: We believe this is one of the oldest rubber expansion joint installations in existence. If you know of, and can authenticate, an older one, we'd like to hear about it, and we'll send you a $100 U. S. Savings Bond.

US RUBBER

Mechanical Goods Division

United States Rubber

Rockefeller Center, New York 20, N.Y.

In Canada: Dominion Rubber Company, Ltd.

LABORATORY CONTROLLED...

Crapo

GALVANIZED STEEL STRAND FOR GUY, MESSENGER and OVERHEAD GROUND WIRE

The high, uniform, consistently-dependable quality of Crapo Galvanized Steel Strand is the direct result of close laboratory control over each step in manufacture. All wires used in forming a particular size and grade are produced from steel of selected analysis, carefully processed under technical supervision and stranded on precision machines. Both wire and finished strand are subjected to prescribed laboratory tests to insure the desired end result.

Heavy, uniform, tightly-bonded zinc coatings, applied by the famous Crapo Galvanizing Process, provide maximum resistance to corrosion.

Write for booklet OG-25 containing "Sag and Tension Data for Overhead Ground Wire."

INDIANA

STEEL & WIRE CO., INC., Muncie, Indiana

MLT-32 3-phase step **voltage regulators** rated 1,000 kva and below have static voltage-regulating relay to simplify setting and maintenance of voltage level and bandwidth. Bandwith from 1½ to 6-v and voltage level from 105 to 135-v can be accurately dialed on the control panel.—General Electric Co, Schenectady 5, N. Y.

Portable reel **lift-stand** requires only two men to set up full reels of 500,000 or 750,000 Mcm. The Reelift provides a safe, rigid base for fast cable pay-out and can be readily adjusted to handle reels of any diameter up to 48 in.—Hykon Manufacturing Co, Box 923, Alliance, Ohio.

Model C-direct **projector** projects opaque copy, transparencies or objects directly onto heavy illustration board. Four element, color corrected f4.5 lens gives 450% reduction and 400% enlargement.—M. P. Goodkin Co, 24 Beach St, Newark 2. N. J.

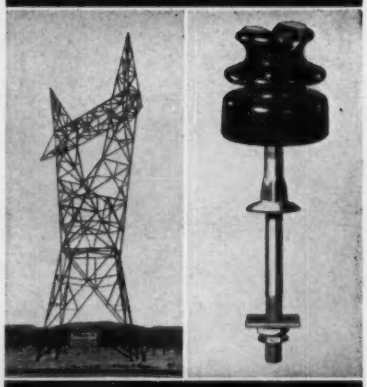
DER 331 **epoxy resin** is a standard unmodified resin suitable for electrical encapsulating; 334 is a modified low viscosity resin especially suited for laminating.—Dow Chemical Co, Midland, Mich.

Vertical tube furnace for pilot plant or laboratory provides protective atmosphere, cooling chamber and accurate stepless temperature control up to 2,750F. Self-contained unit has all components in the bottom part and is completely prewired and piped.—Lindberg Engineering Co, Pilot Plant Equipment Div, 2444 W. Hubbard St, Chicago 12, Ill.

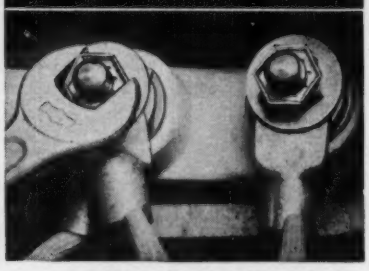
Correction

Dry-type transformers with aluminum conductors available from General Electric Co feature weight reduction—the weight of a typical 750-kva unit is reduced approximately 1700 lb. A listing in Electrical World, Jan. 20, p. 80, gave the "reduced" weight as 11,500 lb which is the weight of a non-aluminum wound unit of the company.

Assemblies stay tight!



Connections stay tight!



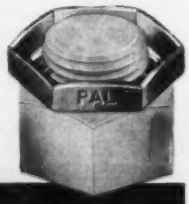
—when locked with

PALNUT LOCK NUTS

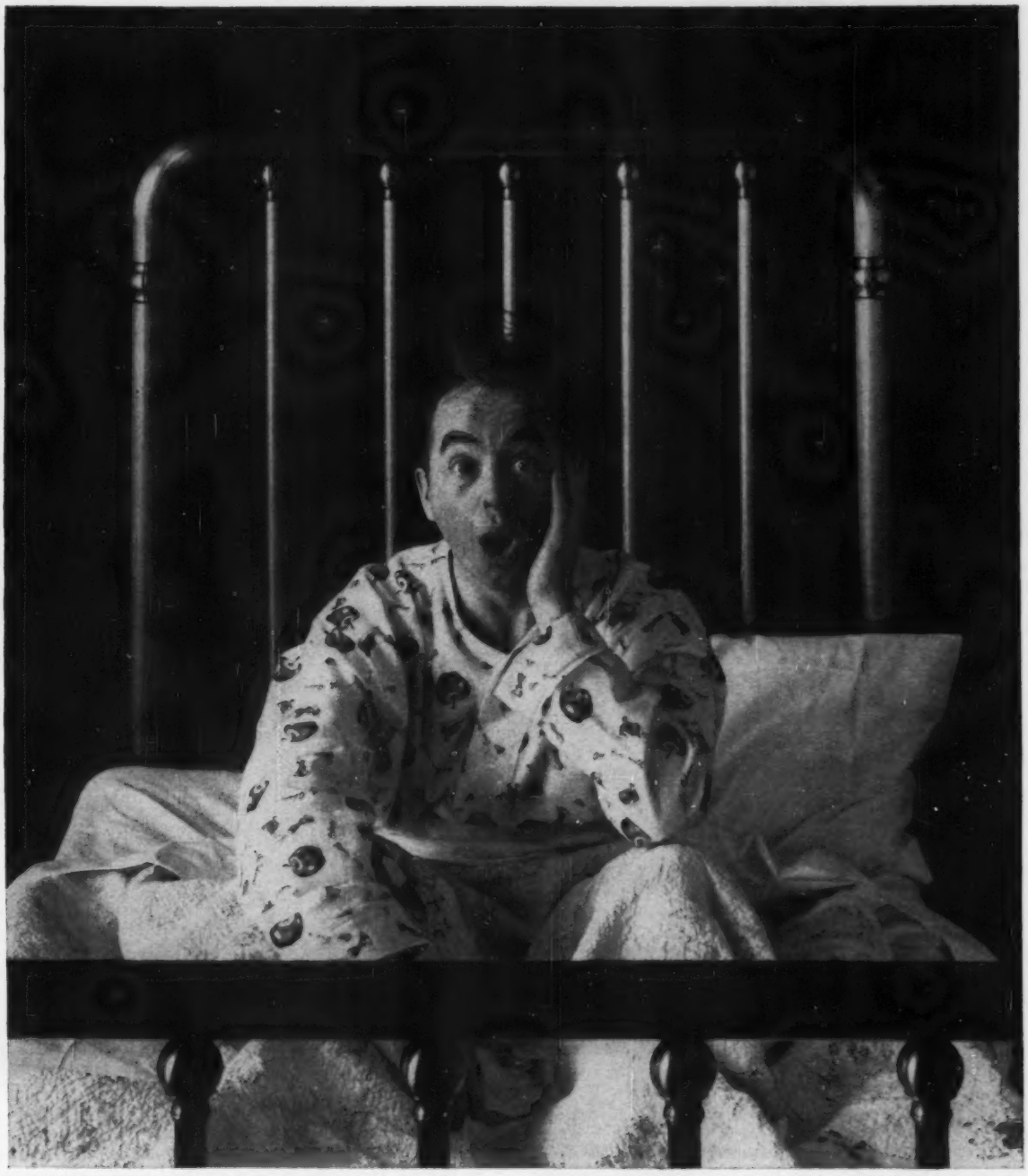
FOR years, PALNUTS have been the standard lock nuts of the utility industry—on steel towers, wood pole hardware, connectors, disconnects, switches, fittings, transformers, etc. Here's why: PALNUT Lock Nuts stay tight under severest vibration, are very low in cost, apply fast and easily, require little space. Available in full range of sizes, in plain, Parkerized and Hot Dip Galvanized steel; also silicon bronze.

Samples and literature on request.

THE PALNUT COMPANY
51 Glen Road
Mountainside, N. J.



PALNUT
TRADE MARK
LOCK NUTS
for quick, secure fastening at low cost



I dreamed I paid $1,000 for a cutout!

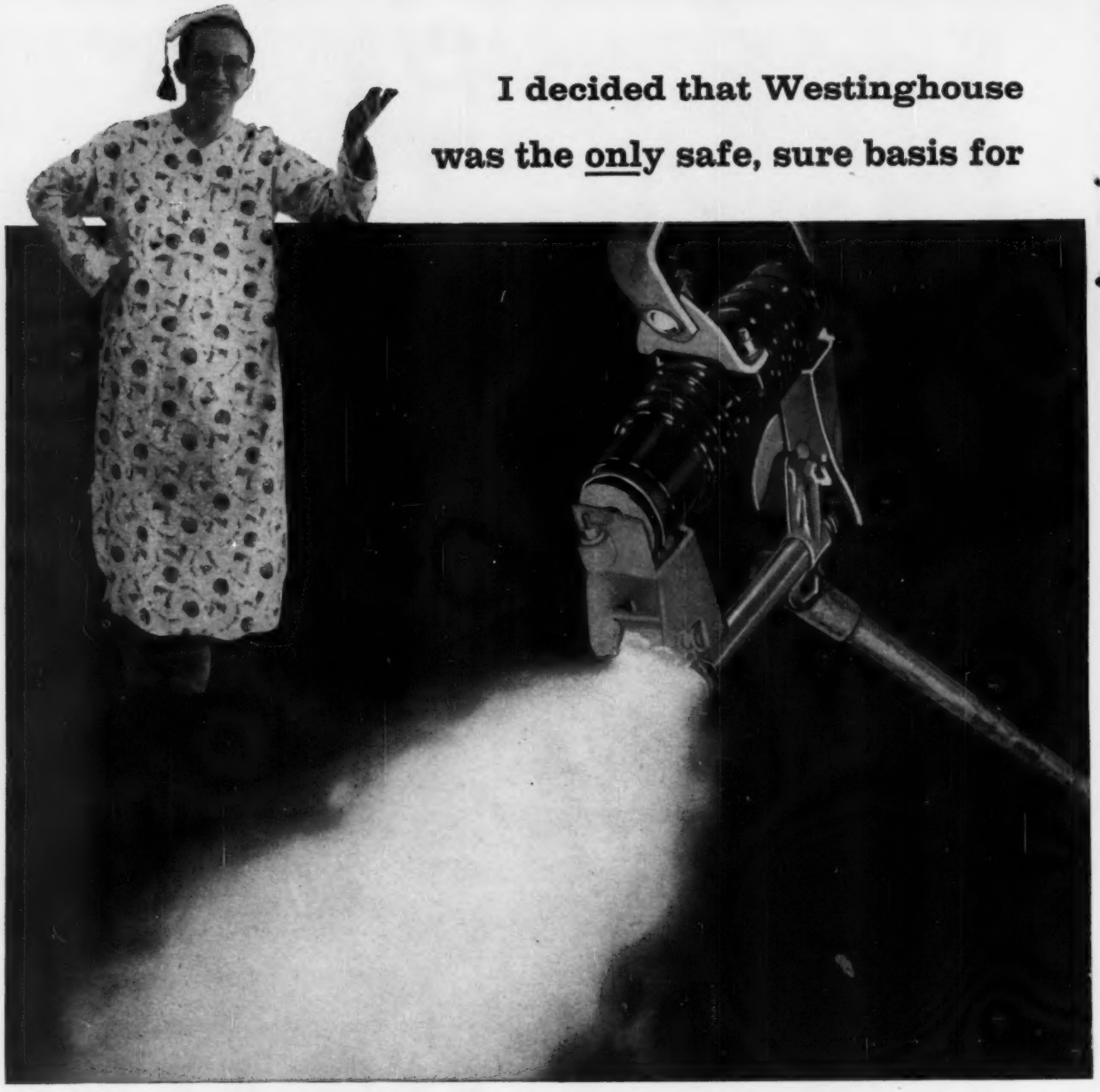
I woke up the other night in a cold sweat. This dream was as real as life . . . *a thousand bucks for a fuse cutout* . . . wow, what a nightmare!

But . . . then I realized that if the cutouts I bought didn't give me the *protection* I thought I was buying (even though their initial cost was pretty small) . . . the "real cost" of a single cutout *could be* as much as $1,000. If a sectionalizing cutout failed, the "real cost"—the resulting damage—could easily reach this amount. A cutout failure could mean a major outage with loss of revenue and customer good-will, cost of an extra service trip to replace the cutout and perhaps even damage to expensive adjacent equipment.

I'm sure glad it was only a dream . . . but it made me stop and think about this problem. How did we *know* our fuse cutouts would really interrupt rated faults? *Was I really getting full value for my protection-investment?*

J-60948-1

Turn the page to learn how Westinghouse promises PA's a sound night's sleep



I decided that Westinghouse was the only safe, sure basis for

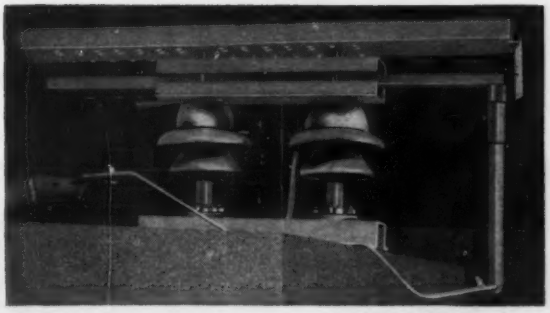
Their grueling development test procedure guarantees me full value for my protection-investment

After my $1,000 cutout nightmare, I visited the Westinghouse High Power Lab to watch them testing their open-fuse cutouts. They have the toughest battery of tests I've ever seen. It really opened my eyes the way Westinghouse cutouts shrugged off those punishing shocks from high-current interruptions. The DX cutout cleanly interrupted all faults from minimum melting of the fuse link right up to the maximum interrupting rating of the cutout . . . and then the same fuse tube cleared currents even 150% above their maximum rating without a single tube failure or flashover.

Watching the wallop some of these high-current interruptions gave the cutout really put across the importance of rugged components such as hinges, clamps, brackets and porcelain insulators. I never dreamed (no pun intended) a manufacturer spent so much money in testing and developing a product that's so inexpensive we'd come to regard it as just another piece of hardware. In the Westinghouse High Power Laboratory and High Voltage Labs, I witnessed an exhaustive series of tests: interrupting, temperature rise, radio interference, impulse tests, wet and dry withstand tests, vibration tests . . . and even severe packaging tests.

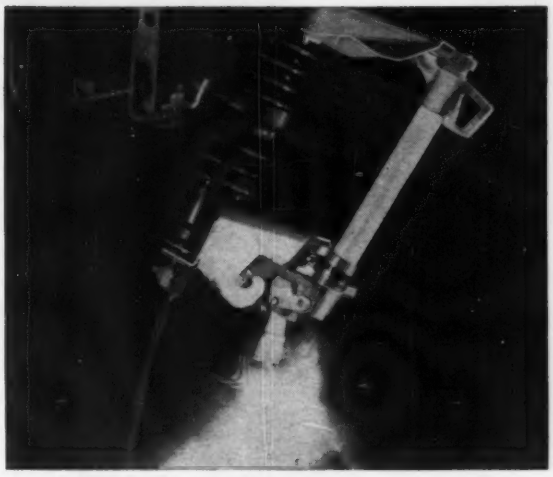
And when the design engineer was confident enough to walk up to the DX cutout and casually close in on a fault of 100% of its interrupting rating (as shown in the Lab above), I knew I was getting all the protection we were paying for . . . and a whole lot more . . . when we bought Westinghouse fuse cutouts. J-60948-2

complete electrical testing selecting a cutout!



Here's how Westinghouse **PLOWBACK** of earnings into research insures full value for your protection-investment!

Anyone can set up a test on a cutout. All it takes is a fairly large transformer, a breaker and a cutout. But, to start with fundamental research on the rocket action of the basic fuse tube of various materials, sizes and lengths and follow-through to the final verification tests on the complete product . . . testing each part that is subject to the shock of interruption . . . takes engineering know-how, time and test facilities . . . found only in the Westinghouse High Power Laboratory. This time-consuming but sure method of development costs money . . . lots of it, but really sure protection comes only from thorough electrical testing as was used in the development of the Westinghouse DX cutout and not from a design based on theory alone.



Completely safe load breaks

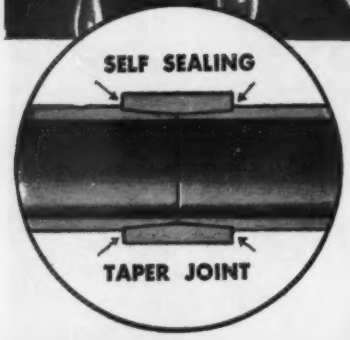
Load break interruption at full rated capacity proved the complete safety of this device for manual sectionalizing of distribution lines and capacitor switching. Arc is extinguished inside rugged Micarta® tube . . . with no arcing at contacts. This Westinghouse load break device provides a safe, easy and economical circuit interrupting device.

For full details about the "plus values" in Westinghouse DX open-fuse cutouts, call your Westinghouse sales engineer or write to Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania.

YOU CAN BE SURE...IF IT'S **Westinghouse**

J-60948-3

WATERTIGHT!



Orangeburg Fibre Conduit Prolongs Cable Life

Keep out corrosive ground waters, and you prolong the life of underground cables, say utility engineers!

Why? Because ground waters containing corrosive elements derived from the soil and concrete encasement attack cable sheath and shorten cable life. Orangeburg's impermeable wall and self-sealing Taper-Sleeve Joint shed them *"like water off a duck's back."* You get maximum protection with Orangeburg.

Orangeburg protects cables in many other ways. Smooth bore, low co-efficient of friction reduce incidence of abrasion. Its material is strong, tough, resilient, durable.

No other conduit is easier to install

Light, 8-foot lengths and a complete line of bends and fittings speed installation. Taper-Sleeve Joints tap water-tight in a jiffy. Orangeburg lays faster and at lower cost than any other type of conduit.

Orangeburg Fibre Conduit has prolonged cable life at minimum expense for utilities, municipalities and industry since 1893.

Distributed by Graybar Electric Company and by General Electric Supply Company. Branches and stocks in principal cities.

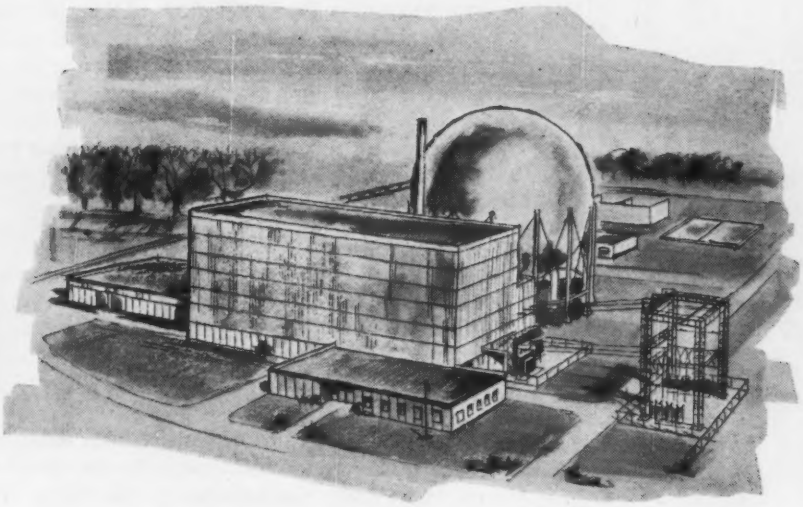
WRITE DEPT. EW-48 FOR CAT. 52

ORANGEBURG MANUFACTURING CO., INC., Orangeburg, N. Y. West Coast Plant, Newark, Calif.

ORANGEBURG®

FIBRE CONDUIT

Report on
Nuclear Power



What Do We Know About Nuclear Power Costs?

Evidence presented at the Atomic Energy Management Conference held recently in Chicago leads to two conclusions about the costs of nuclear power:

1. Present estimates of nuclear power costs are still little more than guesses. We have little experience on which to base these estimates, and they rest on a foundation that is made up largely of assumptions.

2. There are many areas in which costs can be greatly reduced. Whatever the costs of nuclear energy are now, they are certain to fall drastically as our experience increases.

Estimates of nuclear costs frequently indicate a degree of certainty much greater than the facts justify, Louis H. Roddis, Jr., deputy director of AEC's Division of Reactor Development, told the conference. As if to confirm Roddis' statement, other speakers presented cost estimates ranging from 7½ mills to 65 mills per kwhr for electric energy generated in nuclear plants. There were even wide variations in estimates based on the same type of nuclear reactor.

Chief reasons for the variance revolve around unknowns and the differences in assumptions made by the estimator. William Webster, executive vice president, New England Electric System, said that all estimates on the Yankee Atomic Project have been based on 6% return, 20-year life, and net capability. If assumptions are changed to 4% return, 35-year life, and gross capability, there would be a difference of 30% in estimated cost per kwhr, he said.

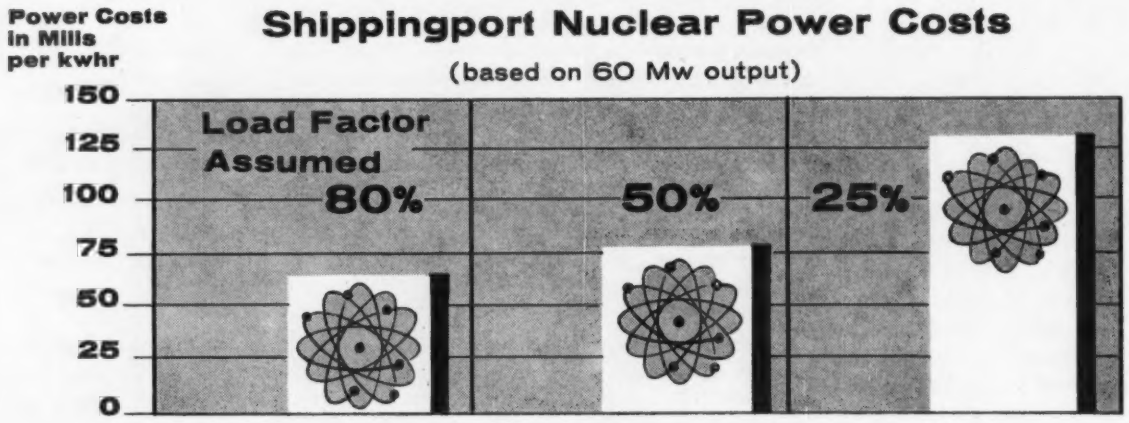
These are not the only assumptions that must be made. The average load factor at which the nuclear plant is to operate throughout its life has a gigantic effect on costs. And since no one has yet observed the life cycle of a nuclear plant operating as part of a power system, the load factor must be assumed.

A lifetime load factor of 50% for the typical nuclear plant was assumed by a panel of the Joint Congressional Committee on Atomic Energy late in 1955. This figure included an allowance for increased operation of nuclear plants. Said the panel: "Since nuclear plants are expected to have lower production costs (fuel plus operation and maintenance) than conventional plants, it is expected that in the middle years of their life nuclear plants will be operated at somewhat higher load factors and conventional plants at somewhat lower load factors . . . Accordingly it is assumed that the lifetime load factor of nuclear plants is 50% instead of the 43% calculated."

Many nuclear cost comparisons assume higher load factors than 50%. This can be defended. Since today's reactors cannot compete economically with conventional plants and are being built primarily to gain experience for the future, the load factors at which they operate will not be determined strictly by economics.

But as more efficient nuclear plants are built and join the system, they will offer economy if operated at high load factor. And this will probably relegate the original nuclear plant to peak operation, so that over its lifetime the load factor at which it operates should follow a pattern not unlike that of the conventional plant.

To make assuming load factor still more difficult, experience from the first 100 hours of operation at Shippingport has shown that a new pressurized water reactor is ideally suited for taking load swings. But engineers conjecture that as the plant gets older its system will build up poisons which will slow down its flexibility. Depending on future economics, this brings up the interesting possibility that new nuclear plants added to a system will be assigned the regulating duty, while older nuclear plants will be base loaded.

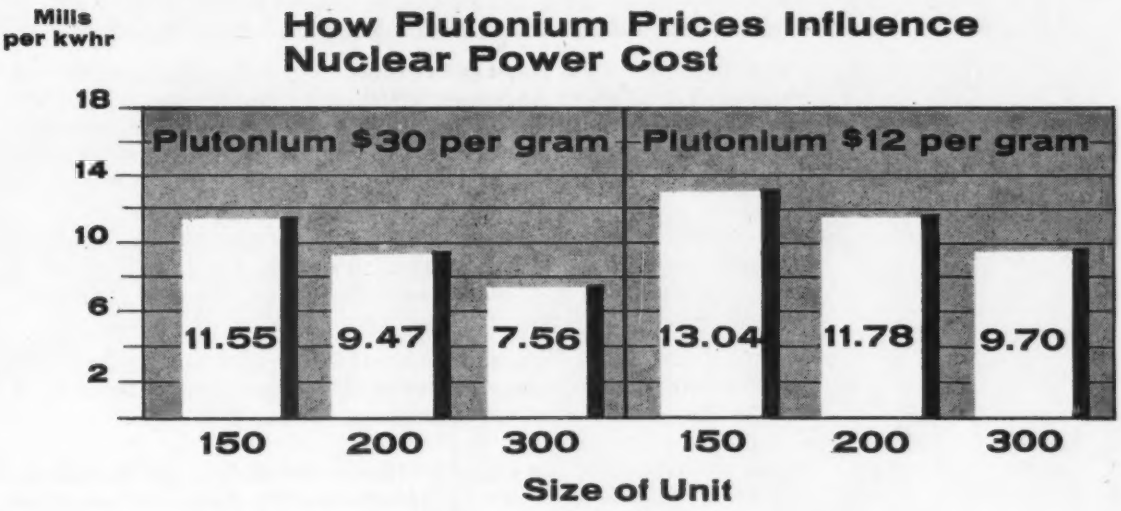


The assumed load factor makes a big difference in the energy cost estimate for a nuclear plant. How big a difference can be seen in the chart above. In the Shippingport reactor, raising the assumed load factor from 50% to 80% cuts energy costs by about 24 mills per kwhr.

Only time will tell what factor should be used in estimating energy cost. But meanwhile, this very uncertainty argues that energy cost comparisons between nuclear and conventional plants should be made with the same load factor assumed for each, to reduce confusion at least.

Fuel costs also are subject to assumptions which may or may not be valid. An example is "plutonium credit." The government now pays $30 per gram for

the plutonium produced in reactors. This credit cuts fuel cost and therefore reduces the cost per kwhr. Arthur S. Griswold, vp of Detroit Edison Co, showed the conference how a drop in plutonium prices to $12 per gram would affect energy cost in a breeder reactor (see chart below).



But wherever nuclear power costs stand now, they are coming down. Several speakers outlined areas where costs have been cut and where they will be cut still further.

Reactors can be operated above design output. Argonne's Experimental Boiling Water Reactor has operated at 61.7 thermal Mw; it was designed for 20 Mw. Although electrical output of EBWR is limited by the turbine, future reactors of this type can be built to make use of this thermal dividend. This will slash cost per kwhr.

Plant costs can be cut in many places, W. E. Shoupp, technical director of Westinghouse Atomic Power Dept, told the conference. Engineering cost of present plants is high because, paradoxically, "so much technical effort is spent on plant simplification and cost reduction." But this will lead to more economical nuclear power. Specifically Shoupp cited cost reductions realized from changes in system arrangement and simpler installation, and expressed the belief that the vapor enclosure could eventually be eliminated altogether from the pressurized water reactor.

An example of how design can be changed to reduce costs comes from the Argonne EBWR. Some of the turbine blades are nickel plated and some are not. The arrangement was set up to determine the advantages of plating where some radioactivity is likely to be present. When the unit was opened for inspection after a year of operation, said Argonne's Dr. B. I. Spinrad, both plated and unplated blading were in good condition. Therefore elimination of the nickel plating will be recommended in future designs.

Plant costs per kwhr will also go down as plants get larger, and as components are produced in larger volume.

Costly safety systems may be trimmed as operating experience grows. Shoupp mentioned one case that "requires a five-fold accident coincidence in one of

our plants that 'might' cause an incident. Protection for this one item," he said, "adds over $500,000 to the plant cost."

Fuel costs will be cut. Use of uranium oxide was mentioned by W. B. Lewis, of Atomic Energy of Canada, Ltd, who said that scientists at Chalk River, Ont., have hopes that fuel costs may be held to 1.0 mill per kwhr.

The Canadians use dense, sintered UO_2 in a heavy-water moderated reactor. The fuel withstands high burn-up (long use of a fuel element) without swelling.

The Canadians are also pursuing the cheaper aluminum-nickel cladding, and are looking for cheaper fabrication. "With some justice," said Lewis, "the fabrication of fuel assemblies has been criticized as like Swiss watch-making. What we envisage is more like German toy-making." These fuel elements would be used up and then disposed of without reprocessing.

Reprocessing costs are now an expensive item. The spent fuel element, containing uranium, plutonium, and other radioactive fission products and clad in zirconium or stainless steel, must be dissolved chemically. Then the uranium, plutonium, and cladding must be separated and taken out of solution for reuse.

At present reprocessing costs seem fixed, said Shoupp of Westinghouse. But he added that time and experience will allow easier reprocessing to be designed into the fuel element, which will reduce cost.

Where are we now in cost reduction? Based on today's design information, Shoupp said, fuel cost for a new 125-150 electrical Mw pressurized water plant would be about 5.5 mills per kwhr, and total power cost about 14 mills per kwhr, a substantial reduction from Shippingport's 64 mill power.

And for the short range future? Assuming reasonable development of cost savings in fuel and plant design, Shoupp told the conference, a similar plant might be built to produce power at 8.5 mills per kwhr, or 9.7 mills per kwhr if the price of plutonium dropped to $12 per gram. This, he emphasized, is not the ultimate cost reduction.

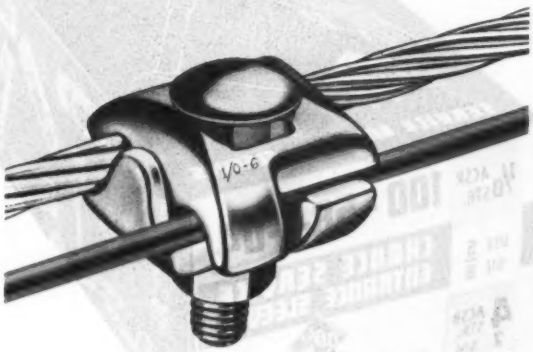
But most speakers at the Atomic Energy Management Conference agreed that long-term nuclear power costs are still in the province of speculation.

Costs for Pressurized Water Systems

Total Power Costs-mills per kwhr	Present	Future
Capital	7.5	5.0
Operation & Maintenance	0.9	0.7
Fuel ($12 Pu)	+7.1	+4.0
Total ($12 Pu)	15.5	9.7
Total ($30 Pu)	13.9	8.5

Fuel Costs-mills per kwhr	Present	Future
Uranium Cost	6.80	3.96
Uranium Credit	−4.88	−2.35
	1.92	1.61
Plutonium Credit	−1.07	−0.80
	0.85	0.81
Losses	+0.13	+0.07
Fissionable Material	0.98	0.88
Uranium Inventory (4%)	0.88	0.76
UF_6 to UO_2 Conversion	0.41	0.12
Core Fabrication	3.36	1.31
Core Capital	0.54	0.35
Reprocessing	0.64	0.45
Shipping & Insurance	+0.30	+0.14
Fuel Cost ($12 Pu)	7.11	4.01
Fuel Cost ($30 Pu)	5.50	2.81

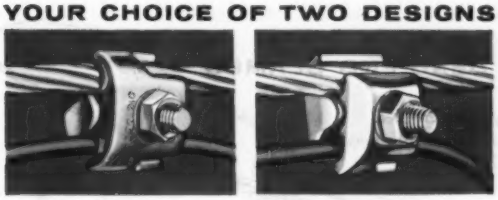
Users know they can install Chance Clamps and Connectors with complete confidence



* Parallel Groove Clamps

Chance Parallel Groove Clamps are designed for low cost, easy to install, efficient power line connections. Heat-treated aluminum alloy body has high resiliency to keep connections tight under all loads and temperature conditions. Available in two types: "AA," uncoated aluminum body . . . and "AGP," with a heavy coating of Chance FORTIFIED Cadmium that resists electrolysis and corrosion in any bimetal connection.

YOUR CHOICE OF TWO DESIGNS



PG 200 SERIES **PG 100 SERIES**

PG 200 Series Clamps have fingers that interlock around the main line and tap line. PG 100 Series Clamps have a wide jaw for the main line—interlocking fingers for the tap line. Both clamps contact ALL outside strands of ALL recommended conductor sizes. Chance Parallel Groove Clamps are also available in 2 and 3 bolt types for heavy service connections.

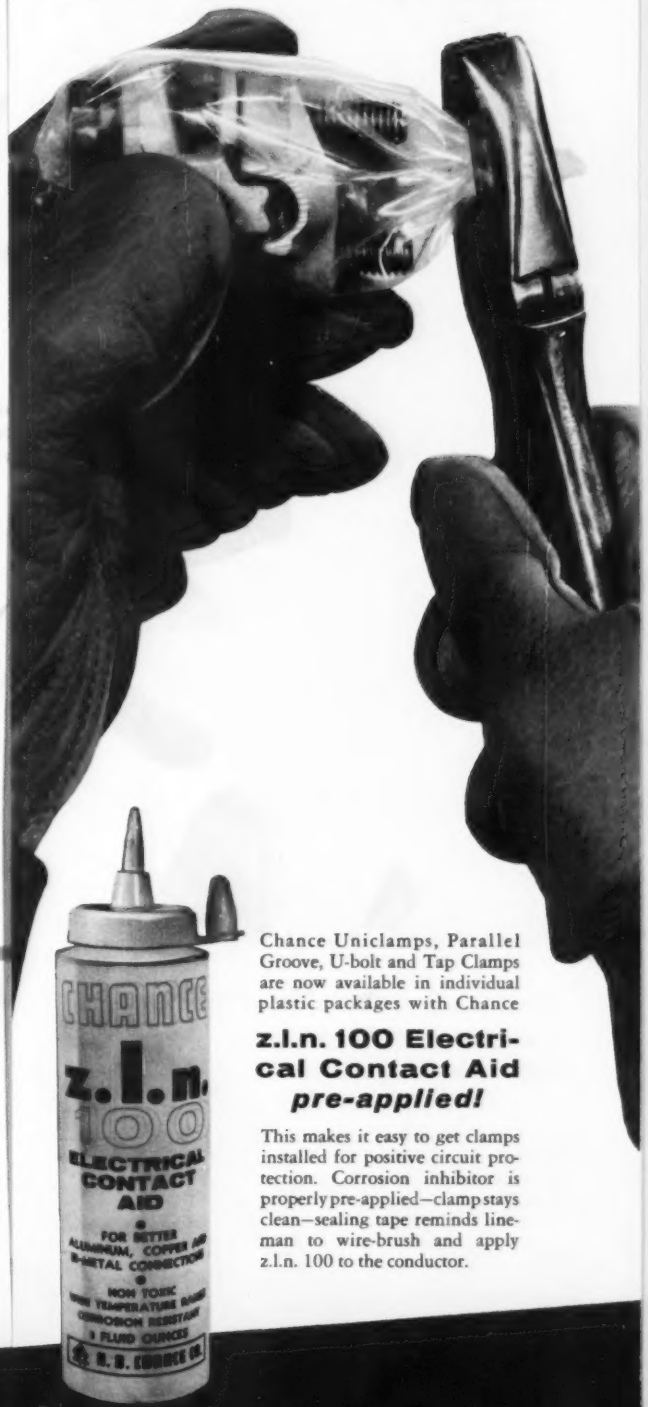
* CHANCE *PC* CLAMPS

Chance "Protected Connection" Hot Line Clamps are counter-balanced, light in weight, and have extra wide jaws for *conductor protection* . . . shielded high-strength spring for *contact protection* against thermal contraction and expansion . . . have threads enclosed in a chamber of lubricant, out of the arc zone, for *thread protection* . . . and are available individually packaged for extra circuit protection.

You can spot it by the RED EYE SCREW

Use AGP with heavy fortified cadmium coating for bimetal connections . . .

PACKAGED FOR CIRCUIT PROTECTION!



Chance Uniclamps, Parallel Groove, U-bolt and Tap Clamps are now available in individual plastic packages with Chance

z.l.n. 100 Electrical Contact Aid *pre-applied!*

This makes it easy to get clamps installed for positive circuit protection. Corrosion inhibitor is properly pre-applied—clamp stays clean—sealing tape reminds lineman to wire-brush and apply z.l.n. 100 to the conductor.

Users know they can install Chance Clamps and Connectors with complete confidence

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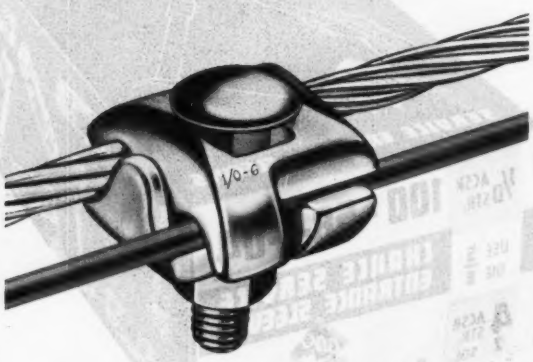

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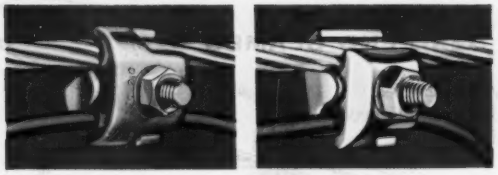

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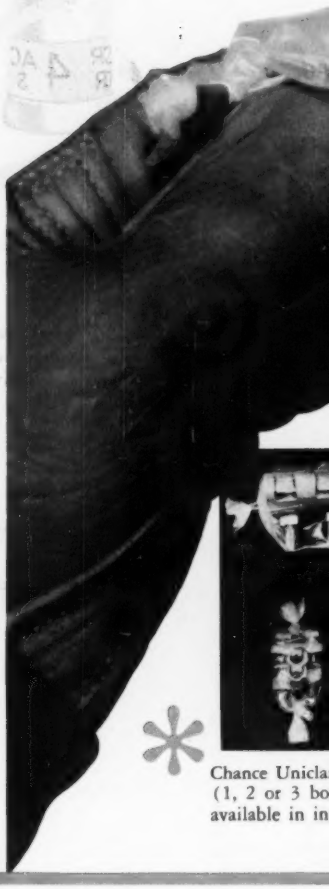

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You can spot it by the RED EYE SCREW

Use AGP with heavy fortified cadmium coating for bimetal connections . . .

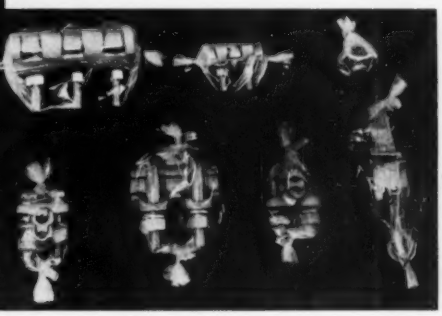
UNICLAMP

The "one-piece" Uniclamp is popular with engineers who appreciate its high thermal efficiency, and with linemen because it can be installed without taking it apart. Available with aluminum, AGP (General Purpose) or copper bodies. For transmission or heavy duty distribution connections. Uniclamps can be applied with hot line tools.

GENERAL O

nce puts engineering skill tail to protect your circuit

D. C. HUBBARD, Chief Engineer, Chance Conductor Specialties, says: "In choosing clamps and connectors, remember, that they can protect—or damage—the most important part of your circuit . . . the conductor. That's why Chance puts so much engineering into every tiny detail of clamp and connector design—to *protect your conductor.*"



ce Uniclamps, U-Bolt Clamps, Parallel Groove Clamps or 3 bolt) and even Chance "Hot Tap" Clamps are ble in individual packages with z.l.n. 100 pre-applied.

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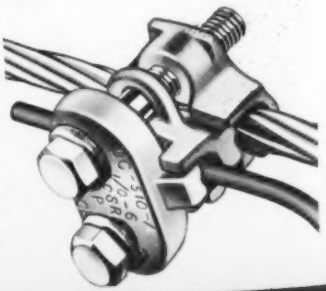
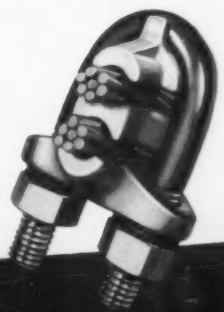


* U-BOLT CONNECTORS

Use these to make tight, low-resistance transmission and important heavy duty distribution connections. Aluminum bodied, in 1 and 2 bolt types for aluminum or ACSR connections. Designed to prevent "bird-caging" under surge conditions.



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ERAL OFFICES: CENTRALIA, MO. (A. B. Chance Company of Canada, Ltd., Toronto)

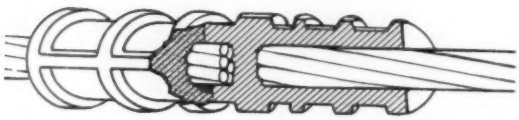
There's always a CHANCE for a better connection

SERVICE ENTRANCE COMPRESSION SLEEVES

Chance Service Entrance Sleeves are made in wide range of sizes to connect #10 Str. AWG through 1/0 ACSR conductors. They can be applied with any standard compression tool.

Color Coded and Plainly Marked

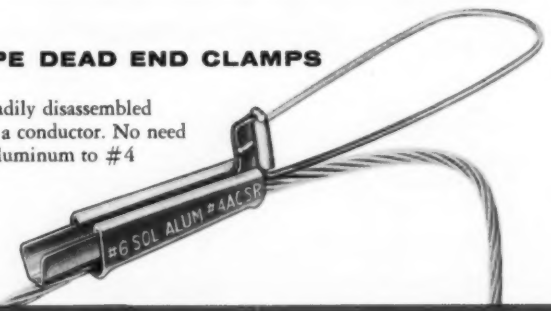
You have quick identification of conductor sizes for each sleeve with easy-to-read, color coded tapes on both ends of the sleeves and the same color coding on the box.



Metal wall in center of sleeve separates conductors—improves bimetal connections. Sleeves are filled with z.l.n. 100 Electrical Contact Aid for best conductivity plus corrosion resistance.

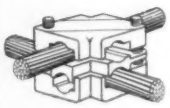
NEW... SERVICE ENTRANCE WEDGE-TYPE DEAD END CLAMPS

Use these clamps for better service drop construction. Can be readily disassembled and assembled, without tools, for easy fastening to any point on a conductor. No need to thread conductor through the clamp. Range from #6 Solid Aluminum to #4 ACSR 6/1 or 7/1.



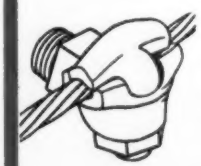
SPLIT-BOLT CONNECTORS

Give high conductivity plus strength. These Chance copper connectors have the same characteristics as the conductor they connect. You get an efficient cool operating joint that stays tight because both clamp and connector have the same coefficient of expansion. Sizes to fit #10 to 1/0 Str. conductor.



MULTI-TAPS

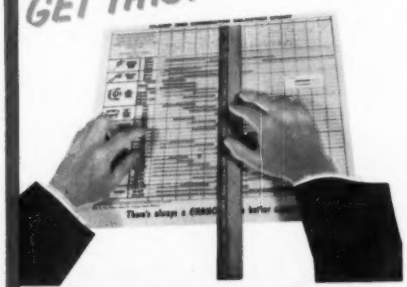
For cross T, end to end, and parallel connections. Three sizes meet all requirements.



GROUNDING TERMINALS

High strength copper alloy connectors designed for grounding transformer tanks.

GET THIS!



CLAMP AND CONNECTOR CHART It helps you pick quickly—by catalog number—the Chance Clamps or Connectors for any specific job. Write for your FREE chart today.

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CCSB-8

Estimating Unmetered Heat Customers' Bills

E. G. POOLE, Commercial Consultant, Seattle City Light, Seattle 4, Wash.

Billing the increasing number of residential electric space heating customers has posed some special problems for utilities as they get deeper into this new kind of business.

For example, what do you do when it is necessary to prepare a bill for an account which, for some reason, has been served unmetered for a time? (The service has been on closed loop; or the meter has gone dead; or has been connected to run backwards.)

Former practices of repeating the previous bill, or prorating on the basis of a sample run of kwhrs when metering is restored, or using a bill from the corresponding period of the previous year are not valid because electric heat consumption fluctuates too much to make such estimated bills dependable.

There is, however, a way to get a fairly accurate bill by using a technique borrowed from the oil industry. The oil dealer, who tries to maintain an automatic full supply system for customers' tanks is able to do so without ever measuring them between fills. He estimates customers' needs by using deg-day records, plus some study of their individual heat case histories. These two components form the basis of each customer's "K" factor. From it he can easily schedule his automatic fuel deliveries.

This principle can be adapted to computing bills for electric heat customers with blank metering records.

Take the billing period immediately before or after the period when the metering failed to function. From the total number of kilowatt hours in such a known period deduct the number of hours used in a typical summer period and assume the remainder to be electric heat usage. Then ascertain the number of degree-days in this known time interval. The number of kwhrs used for heating in the missing period will be in the same ratio to the number of deg-days in that time as the known kwhrs in the adjacent period will to the deg-days of the latter. Thus:

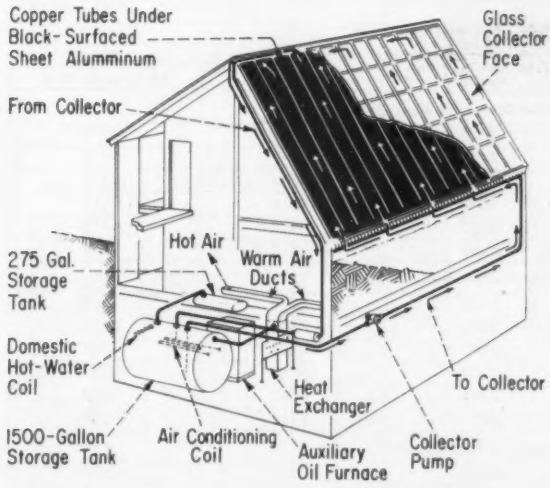
$$\frac{\text{Oct. (missing) kwhrs}}{\text{200 (known) deg-days}} = \frac{\text{Nov. (known) 1500 kwhrs}}{\text{380 (known) deg-days}}$$

This gives the number of heating kilowatt hours to which we must add a typical summer block of domestic or non-heat billing period consumption (previously deducted) to get a complete bill.

If the electric heating is new load added from the time the meter was inoperative, the above principle can be modified by using a 10- or 15-day dry run when the meter is again recording and the deg-days of that partial billing period.

The extra time involved in determining the amount of the bill is justified. Electric heat accounts are lucrative and the customer concerned can be shown that the method is sound.

MIT Solar-Heated House Designed for Cloudless Living



Massachusetts Institute of Technology recently took the wraps off its new solar heated house.

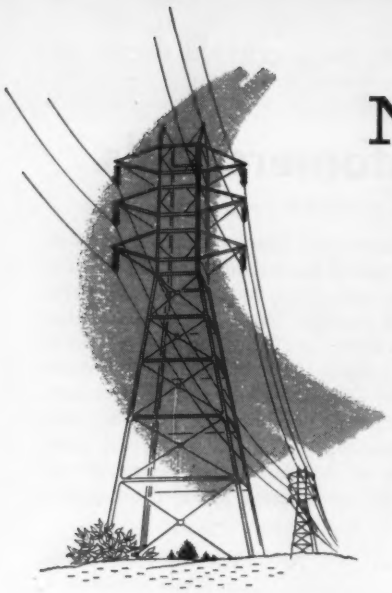
Shown diagrammatically at left, the house is the fourth in a series of experimental solar heating projects the University has conducted during the past 20 yrs. Here's the way it works:

Heat from the sun is collected in the heat trap on one side of the 60-dg slanted roof. This trap is made of glass and thin, blackened aluminum under which copper tubing has been fastened. Water in the tubing absorbs the heat and is carried to a 1,500-gal storage tank in the basement. The hot water goes through a water-to-air heat exchanger and the warmed air is sent through ductwork to the rooms.

A 275-gal oil storage tank takes care of a domestic water heater and a small auxiliary oil-fired system for use when the sun remains behind the clouds too long.

System is designed to use between 30 and 50% of total energy collected by the heat trap.

(*More Selling on page* 134)



NOW AVAILABLE! Reynolds 5005* Aluminum Alloy Conductor in LARGER SIZES

* 5005 is a new high strength all-aluminum alloy conductor developed by Reynolds. It compares with copper in sag . . . costs no more than ACSR. Write for brochure.

PHYSICAL CHARACTERISTICS OF BARE CONDUCTORS

Type of Conductor	Size of Conductor (CM)	Size of Strands, Inches	Cable Dia., Inches	Weight per 1000 ft., Lbs.	Ultimate Strength, Lbs.
336,400 CM—26/7 and 18/1 ACSR Diameter Equivalents					
5005—19 Str. (18/1 Dia. Equiv.)	355,040	.1367	.6835	333	8,911
5005—37 Str. (26/7 Dia. Equiv.)	392,466	.1030	.7210	369	9,989
EC—19 Str.	336,400	.1331	.6660	316	5,940
EC—37 Str.	336,400	.0954	.6678	316	6,420
18/1 ACSR	336,400	.1367	.6835	365	8,625
26/7 ACSR	336,400	(.1138 Al.) (.0885 St.)	.7210	463	14,050
477,000 CM—26/7 and 18/1 ACSR Diameter Equivalents					
5005—19 Str. (18/1 Dia. Equiv.)	503,340	.1628	.8140	473	11,388
5005—37 Str. (26/7 Dia. Equiv.)	556,050	.1226	.8582	522	13,955
EC—19 Str.	477,000	.1585	.7930	448.1	8,090
EC—37 Str.	477,000	.1135	.7950	448.1	8,600
18/1 ACSR	477,000	.1628	.8140	518	11,870
26/7 ACSR	477,000	(.1355 Al.) (.1054 St.)	.8580	657	19,430
636,000 CM—26/7 ACSR Diameter Equivalent					
5005—37 Str. (26/7 Dia. Equiv.)	739,610	.1414	.9898	694	18,041
EC—37 Str.	636,000	.1311	.9180	597	11,240
26/7 ACSR	636,000	(.1564 Al.) (.1216 St.)	.9900	875	25,000

ELECTRICAL CHARACTERISTICS OF BARE CONDUCTORS

Type of Conductor	Size of Conductor	Conductor Diameter, Inches	Resistance, Ohms per 1000 Feet	
			d.c. at 20°C.	60 Cycles at 20°C.
336,400 CM—26/7 and 18/1 ACSR Diameter Equivalents				
5005—19 Str. (18/1 Dia. Equiv.)	355,040	.6835	.0571	.0573
5005—37 Str. (26/7 Dia. Equiv.)	392,466	.7210	.0517	.0519
EC—19 Str.	336,400	.6660	.0516	.0518
EC—37 Str.	336,400	.6678	.0516	.0518
18/1 ACSR	336,400	.6835	.0516	.0518
26/7 ACSR	336,400	.7210	.0516	.0518
477,000 CM—26/7 and 18/1 ACSR Diameter Equivalents				
5005—19 Str. (18/1 Dia. Equiv.)	503,340	.8140	.0403	.0406
5005—37 Str. (26/7 Dia. Equiv.)	556,050	.8582	.0365	.0368
EC—19 Str.	477,000	.7930	.0364	.0367
EC—37 Str.	477,000	.7950	.0364	.0367
18/1 ACSR	477,000	.8140	.0364	.0364
26/7 ACSR	477,000	.8580	.0365	.0365
636,000 CM—26/7 ACSR Diameter Equivalent				
5005—37 Str. (26/7 Dia. Equiv.)	739,610	.9898	.0274	.0278
EC—37 Str.	636,000	.9180	.0273	.0277
26/7 ACSR	636,000	.9900	.0274	.0274

HIGH STRENGTH, LOW COST Reynolds 5005 Aluminum Alloy Conductor is now available in cable sizes larger than 7-strand. *These new cables are designed to permit use of standard accessories.* This eliminates complications associated with accessories required for non-standard sizes. The outside diameters are the same as the outside diameters of conventional ACSR in the 26/7 and 18/1 strandings. The electrical resistance characteristics are approximately the same as those of comparable ACSR and all-EC cables. These larger cables also feature sag characteristics that are a substantial improvement over the all-EC cables and that compare most favorably with those of 18/1 ACSR.

Check these characteristics for yourself in the tables shown on these pages – three typical cable sizes are covered as examples. Chart on catalog availability also shows complete line of larger sizes available. Investigate, too, the cost and labor saving potentials of these new larger sizes of Reynolds 5005 Aluminum Alloy Conductor. Complete data on the physical and electrical characteristics, and sag and tension properties is available now. Contact your local Reynolds branch office, your Reynolds Electrical Distributor or write *Reynolds Metals Company, P.O. Box 1800-EL, Louisville 1, Ky.*

Watch Reynolds All-Family Television Program, "DISNEYLAND", ABC-TV.

COMPARISON OF SAGS OF BARE CONDUCTORS AT 60°F, FINAL MAXIMUM DESIGN TENSION 50% OF ULTIMATE STRENGTH

Type of Conductor	Size of Conductor, CM	Sags (Ft.) for Various Span Lengths											
		Heavy Loading				Medium Loading				Light Loading			
		300	400	500	600	300	400	500	600	300	400	500	600
336,400 CM—26/7 and 18/1 ACSR Diameter Equivalents													
5005—19 Str. (18/1 Equiv.)	355,040	3.6	5.5	8.3	13.0	3.0	4.7	6.9	9.4	2.5	4.1	6.0	8.4
5005—37 Str. (26/7 Equiv.)	392,465	3.5	5.5	7.7	11.7	2.9	4.7	6.8	9.4	2.4	4.0	6.1	8.4
EC—19 Str.	336,400	4.4	9.3	15.1	21.8	4.1	6.4	9.1	13.1	3.4	5.6	8.2	11.3
18/1 ACSR	336,400	3.6	5.7	9.7	13.5	3.1	5.0	7.3	9.9	2.6	4.3	6.5	8.9
26/7 ACSR	336,400	2.7	4.2	6.3	8.5	2.3	3.9	5.8	7.9	1.9	3.3	5.1	7.1
477,000 CM—26/7 and 18/1 ACSR Diameter Equivalents													
5005—19 Str. (18/1 Equiv.)	503,340	3.9	6.0	8.4	12.1	3.3	5.2	7.6	10.2	2.8	4.5	6.7	9.2
5005—37 Str. (26/7 Equiv.)	556,050	3.5	5.5	7.8	10.4	3.0	4.8	6.9	9.4	2.5	4.0	6.0	8.4
EC—19 Str.	477,000	4.7	7.8	12.1	18.5	4.2	6.5	9.3	12.6	3.5	5.8	8.4	11.6
18/1 ACSR	477,000	3.8	5.8	8.2	11.3	3.2	5.1	7.4	10.0	3.1	5.1	7.4	10.0
26/7 ACSR	477,000	2.7	4.5	6.5	8.8	2.3	4.0	5.9	8.0	1.8	3.5	5.2	7.2
636,000 CM—26/7 ACSR Diameter Equivalent													
5005—37 Str. (26/7 Equiv.)	739,610	3.7	5.6	8.0	10.6	3.1	4.9	7.1	9.7	2.5	4.2	6.3	8.7
EC—37 Str.	636,000	4.6	7.0	10.1	14.8	4.0	6.3	9.1	12.3	3.4	5.6	8.2	11.3
26/7 ACSR	636,000	2.8	4.6	6.7	9.0	2.4	4.0	6.0	8.3	2.1	3.5	5.5	7.5

5005 MULTILAYER CONDUCTORS AVAILABILITY LISTINGS

Code Word	Area of Cross Section		ACSR Physical Dia. Size, CM	Number and Diameter of Strands	Cable Dia., Inches	Ultimate Strength, Lbs.	Wt. per 1000 Ft. Lbs.	Standard Reels			
	CM	In.²						Length each Piece, Feet	Number Pieces on Reel	Reel Size	Pounds on Reel
Ratch-Bare	281,460	.2211	266,800—18/1	19 x .1217	.6085	7,064	264	6,894	1	48A	1820
Radar-Bare	355,040	.2789	336,400—18/1	19 x .1367	.6835	8,911	333	11,306	1	63A	3765
Rede-Bare	419,450	.3295	397,500—18/1	19 x .1486	.7430	10,231	394	9,556	1	63A	3765
Rex-Bare	503,340	.3954	477,000—18/1	19 x .1628	.8140	11,388	473	7,960	1	63A	3765
Ruble-Bare	587,360	.4614	556,500—18/1	19 x .1758	.8790	13,289	552	6,821	1	63A	3765
Sabot-Bare	311,120	.2444	266,800—26/7	37 x .0917	.6419	8,029	292	15,171	1	63A	4430
Scud-Bare	392,470	.3083	336,400—26/7	37 x .1030	.7210	9,989	369	10,352	1	63A	3820
Sepal-Bare	463,245	.3639	397,500—26/7	37 x .1119	.7833	11,626	435	8,782	1	63A	3820
Sine-Bare	556,050	.4368	477,000—26/7	37 x .1226	.8582	13,955	522	6,743	1	63A	3520
Stet-Bare	648,470	.5094	556,500—26/7	37 x .1324	.9268	16,276	609	6,182	1	63A	3765
Spar-Bare	739,610	.5810	636,000—26/7	37 x .1414	.9898	18,041	694	5,504	1	63A	3820
Solar-Bare	927,000	.7282	795,000—26/7	37 x .1583	1.1081	22,283	870	4,046	1	63A	3520

Note: Sizes and strandings other than those listed are available on special inquiry.

Replacing dim, 5-foot-candle system . . .

with modern reflector lamps . . .

New Lighting Reduces Errors, Maintenance

H. M. WHITE, Lighting Engineer, Baltimore Gas & Electric Co, Baltimore, Md.

Fewer production errors, better safety conditions, and reduced maintenance are three of the big benefits of the new lighting system installed at John McKenzie & Co, Inc., structural steel fabricators in Baltimore, Md. Boosting illumination in the work areas to 30 foot-candles, the new lighting makes blueprints considerably easier to read, thus reducing the chance of production errors. And obstacles that used to be hard to see in the dark, shadowy aisles are now clearly illuminated, and the possibility of accidents among the employees is less.

Using a total of 12 kw, the new lighting comprises 16 750-watt R-52 reflector lamps. It replaces eight 200-watt dome units that delivered only five foot-candles.

Another advantage of the new lighting is that unlike the old system its sealed-in reflectors require no washing and maintenance is lower. An extra bonus is the benefit to employee morale. The good lighting helps the workers stay cheerful, energetic, and in the right frame of mind to do a good job.

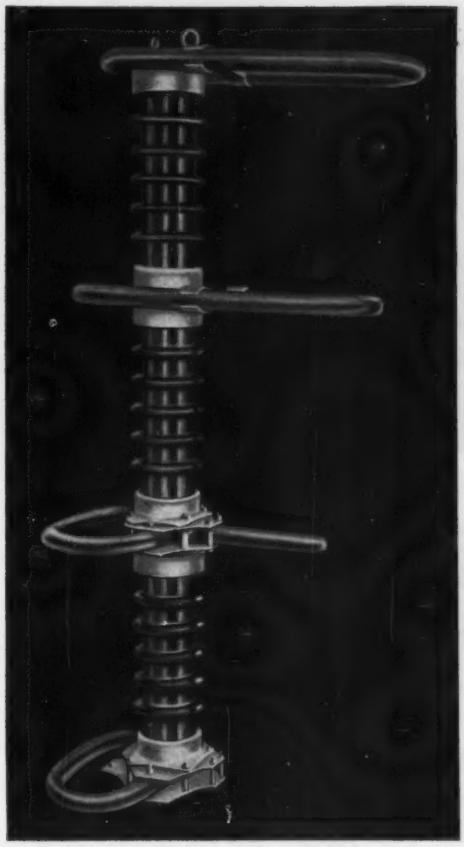
Electrically Heated Solution Speeds Cleaning Process

Y. L. RIPLEY, Power Sales Engineer, West Penn Power Co, Greensburg, Pa.

Electrically heated cleaning baths, used to remove accumulated paint from dip tank hooks cut the cost of the operation by 75% at Fenestra, Inc, a metal floor and wall fabricator in West Elizabeth, Pa. The hooks are used to hold metal parts going through the paint dip tanks. The new method returns the hooks to service sooner, so that fewer are needed. Hooks are cleaned much more thoroughly, and less manual labor is involved.

Each of the two compartments in the bath has two 15-kw immersion heaters, which quickly bring the cleaning solution up to 180 F. and hold it within a couple of degrees of that temperature. Each of the two baskets holds about 200 hooks. Depending on the paint accumulation, cleaning takes 2 to 3 hours.

Formerly, the paint was removed by hand. Later, a cold-solution stripping method was tried. Both methods proved slow and costly. Robert Lewis, manufacturing engineer, says the electric method is not only faster and cheaper but much more dependable.



330-kv device used in field tests

Westinghouse PLOWBACK of earnings provides another new tool for improved high-voltage system operation

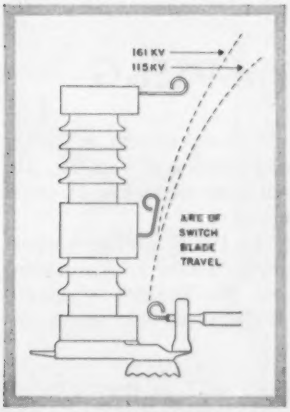
Here is a practical device that eliminates harmful surges on high-voltage systems during no-load operation of disconnecting switches.

Over the years, there have been numerous cases of unexplained equipment failures during switching operations that Westinghouse engineers now have the answer to — thanks to the Company's cooperative investigations with several large utilities in the high-voltage field (330 to 500 kv).

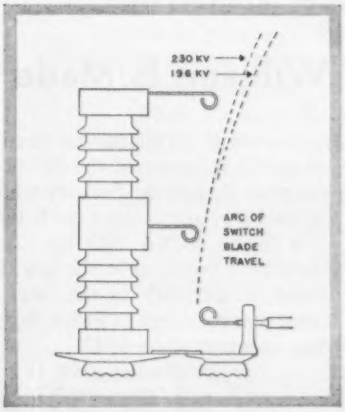
Surges that caused these heretofore unexplained equipment failures can be controlled by the resistor devices now available for addition to Westinghouse Type V horizontal base-mounted air-break switches 115 through 330 kv.

For complete information about the new resistor device, call your Westinghouse sales engineer or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-60950

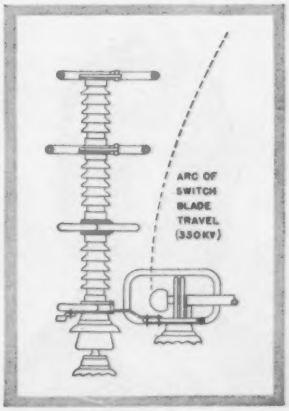
YOU CAN BE SURE...IF IT'S Westinghouse



Device for 115-161-kv Type V

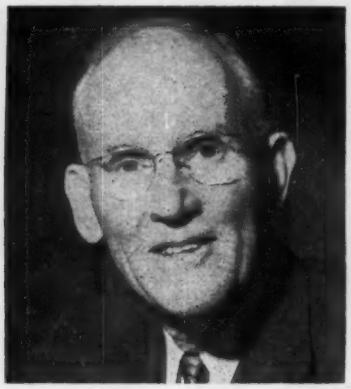


Device for 196-230-kv Type V



Device for 330-kv Type V

W. L. COOPER, *President*



W. C. BELL, *Chairman*

L. A. DUNN, *Asst VP*

United Illuminating Makes Executive Changes

William J. Cooper was recently elected president of United Illuminating Co to succeed William C. Bell, who was named chairman of the board. Laurence A. Dunn, formerly merchandise manager and assistant to the vice president, was elected assistant vice president of the Connecticut utility.

Cooper's broad experience with the company includes service as assistant to the treasurer, supervisor of purchasing and stores, director of employee relations, assistant to the president, and vice president in charge of operations. For the past two years he has been executive vice president. He is also a director of the utility.

Cooper holds an engineering degree from Georgia Institute of Technology and a master's degree in electrical engineering from Yale University. Before joining UI in 1942, he was associated with Georgia Power Co, Central Hudson Gas & Electric Corp, and Line Material Co.

Bell had been president since he joined UI in 1942. As board chairman he succeeds the late James W. Hook. A native of Texas and an engineering graduate of University of California, Bell has been a vice president of the New England Power Association, now the New England Electric System. In 15 years with that utility, he was active in the development and operation of its various subsidiaries. Before beginning his association with NEPA, he had served as general manager of Narragansett Electric Co in Rhode Island. He had also spent 15 years with Virginia Railway & Power Co.

Dunn will remain merchandise manager and will assume responsibility for the company's business in Bridgeport. In the latter post he succeeds Richard H. Van Horn, vice president, who retired last month after 30 years with the utility. A graduate of University of Colorado, Dunn held several sales positions with Westinghouse Electric Corp before joining UI in 1937 as a division merchandise manager.

RUSSELL H. WILLIAMS

Williams Is Made VP of PSE&G

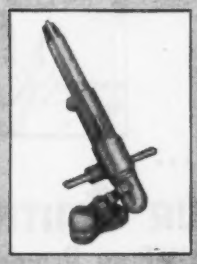
Russell H. Williams has been elected vice president in charge of public relations of the Public Service Electric & Gas Co. He succeeds Robert A. Zachary who retired after more than 28 years in public relations work with the company.

Williams started with the company in 1922, holding various secretarial positions in the law department. Later, he was named assistant secretary to the late Edmund W. Wakelee when the latter was president of Public Service. Williams has been an executive assistant since 1942.

(*More News About People on page* 138)

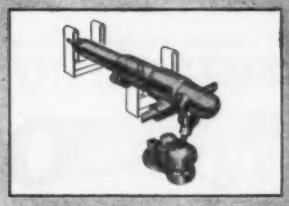
1. SWITCH BLADE IN FULLY OPEN POSITION

Universal link connects blade and crank arm for transmitting forces to the switch blade for full cycle of operation.



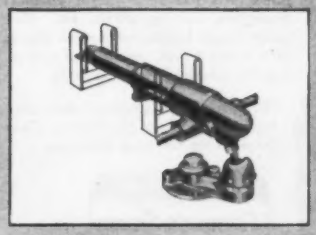
2. SWITCH BLADE CLOSING

Switch blade is moved from the open to closed position by a relatively small angular motion of the crank arm.



3. SWITCH BLADE ENTERS CONTACTS

In this position the switch blade begins its rotation for full contact engagement. Continued movement of the crank arm will rotate the blade to bring contacts under high pressure.



4. SWITCH WITH CONTACTS FULLY ENGAGED

The simple linkage of the WAG concentrates mechanical advantage so that contact engagement or disengagement is accomplished with a minimum of effort.

Simple WAG linkage boosts mechanical advantage; lessens operating effort

In one sweeping, continuous movement the Type WAG Switch blade swings into the open or closed position. There is no lost motion — no cams, triggers, or latches.

The WAG is operated by a simple system of cranks and levers arranged to transmit maximum torque when the blade rotates to engage or disengage the contacts. By concentrating mechanical advantage where it is needed most, the WAG can be operated smoothly and with less effort.

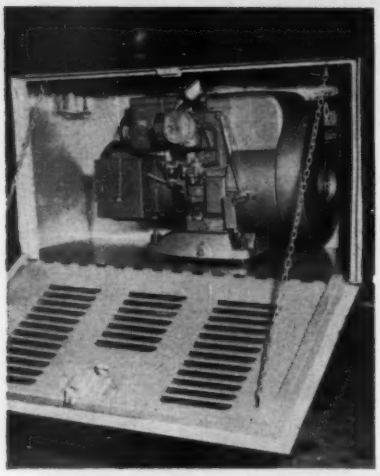
Thus, the Type WAG offers the advantages that engineers recognize as so important: a switch easy to operate, higher contact pressure, and wider contact deflection. The Type WAG has the muscle to break up heavy concentrations of ice and to operate dependably under the most adverse conditions.

For a premium quality switch capable of long, reliable service, choose the Type WAG.

SOUTHERN STATES
EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto

ELECTRIC PLANT
NEWS



Charges truck batteries at far less cost... provides A.C. power, too!

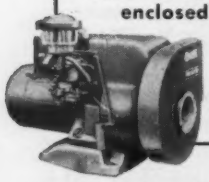
Before the dual-purpose Onan Electric Plant was installed on this maintenance truck, it was necessary to run the 160 H.P. truck engine to charge batteries used for communication. Now, the 2 H.P. Onan Electric Plant does the same job...saving fuel and engine maintenance.

The electric plant is an Onan Model 07AK-1R/972. It has an output of 750 watts A.C. or it can deliver 8 amperes for 12-volt battery charging. Plug-in receptacles are provided for operating electric drills, saws and other equipment used in construction and maintenance work.

Big savings reported!

One utility makes fuel savings alone estimated at $2.00 per day per truck. Another cites an annual saving of $800.00 per truck. This is based on battery charging output only. In addition, the A.C. output makes possible replacing hand tools with electric tools . . . saving time and money.

Vacu-Flo cooling permits enclosed installations



Vacu-Flo cooling is a low-cost optional feature on Onan air-cooled plants up to 10,000 watts.

Other Onan Models: 500 to 75,000 watts A.C., D.C. and Battery Charging

Write for folder showing 3 Packaged Power Systems

Onan
ELECTRIC PLANTS

D.W. ONAN & SONS, INC.
2826A University Ave. S.E., Minneapolis 14, Minn.

PERSONAL BRIEFS

Carl W. Morrow has been elected secretary, and **Carl Fecht** has been appointed purchasing agent of Missouri Power & Light Co . . . **Lynn A. Edenborough** is new assistant area manager at Okmulgee for Public Service Co of Oklahoma . . . **Pete Spiller** is back in purchasing as assistant purchasing agent for Consolidated Edison Co of New York Inc.

Horace L. Ouzts has been named Thermopolis district manager by Pacific Power & Light Co . . . Omaha Public Power District has appointed **C. F. Moulton** assistant general manager of operations.

E. E. Schwalm has been named assistant general manager in charge of power production, distribution, and engineering for the Omaha Public Power District.

Mrs Anne Klotz has been named home service manager of the Toledo Edison Co, succeeding **Mary Dodds,** retired . . . Philadelphia Electric Co has appointed **John J. Natale** manager, Customers Accounts, succeeding **E. N. Keller,** who has retired.

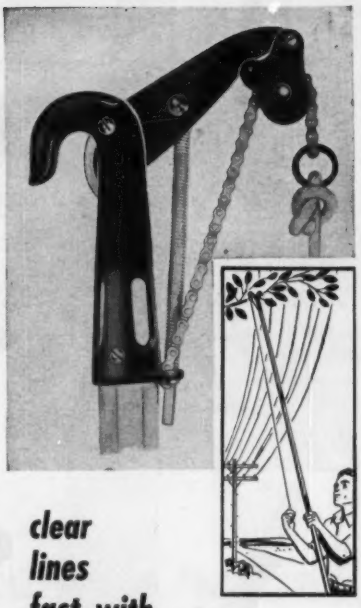
Joseph F. McCahon has been named assistant manager, Customer Accounts and **Robert E. Bryson** has become office manager of Conowingo Power Co, succeeding **D. L. McMenamin,** who has retired.

Howard M. Swartz will join West Penn Power Co's executive staff at Greensburg as director of legal services on April 21. He has been a member of the legal staff of Duquesne Light Co for the past 18 years.

Appalachian Electric Power Co has appointed **Charles H. Evans** plant engineer at the Philip Sporn Plant; **Robert H. Walton** plant engineer at Glen Lyn Plant, and **G. E. Briers, Jr,** plant engineer at the Cabin Creek Plant.

Arthur A. Bean, Jr, formerly editor of the I. & M. News, has been promoted to supervisor of advertising and public information for the Indiana & Michigan Electric Co.

(*More Briefs on page* 140)



clear lines fast with...

SEYMOUR SMITH
"Telephone" Tree Pruner

Here's the standard, the choice of the utility industry for years. Powerful action to cut cleanly—tough and almost unbreakable—easy to handle. No. 12 Pruner Head has 1½" cutting capacity. The lighter, No. 11, handles up to 1" branches. Both are malleable iron castings with tempered steel cutting blade.

Poles (18 ft. 3 sections) are of selected spruce with positive locking, seamless aluminum, telescoping ferrule joints.

FAST CUTTING PRUNING SAWS

Designed for fast, easy cutting—large, deep teeth, finest Swedish charcoal steel, streamlined, laminated hardwood handles. Every model you need up to chain saw work.

No. 20 POLE SAW HEAD

Tough aluminum head with large hook and outside horn for pushing branches, raising wires, etc. Also paint brush holder with wire clamp that holds brush securely. Fast-cutting 16" blade. Poles available.

FREE: Send for Seymour Smith catalog pages on tools for utilities. Keep them on file for easy reference.

Quality Tools
SEYMOUR SMITH
Since 1850

SEYMOUR SMITH & SON, Inc.
2404 Main St., Oakville, Conn.

Here's how Roebling VCV works!

2 Conductor is put under controlled tension, which is maintained during entire insulating process.

3 Butyl insulation is extruded downward around conductor.

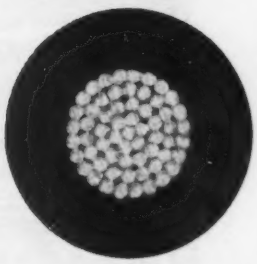
1 Strand wrapped in semi-conducting tape goes up through 4-story, high-temperature tube. This drives out gases and moisture from core, and preheats the conductor for more uniform curing.

4 Vulcanization takes place continuously and uniformly in vertical tube. Constant high steam pressure assures dense, sound insulation.

5 Insulation never touches anything until high-pressure water cooling is complete. The result is unvarying roundness, smoothness and concentricity of butyl insulation.

The Conductor is Always Dead Center

ROEBLING VCV



ROEBLING'S 15 KV CABLE HAS UNIFORMLY HIGH CORONA LEVEL AND DIELECTRIC STRENGTH. VERTICAL CONTINUOUS VULCANIZATION ASSURES UNUSUALLY LONG TROUBLE-FREE CABLE SERVICE.

If you sliced a length of Roebling's VCV 15 kv Cable into cross sections, you'd find that *every inch* is uniform, every inch is round, and in every inch the conductor is exactly centered!

VCV is responsible for the exceptional quality of this new high-voltage cable. No longer will you buy cables in which the conductor has "snaked," or that has flattened, scraped, blistered or abraided insulation. Because insulation is the same thickness and density for the length of the cable, dielectric strength and corona level are uniformly high.

ROEBLING VCV 15 kv CABLES are available in a complete range of conductor sizes and insulation thicknesses

Write today for more facts about the longer, better service you'll get with Roebling VCV High-Voltage Cable. Electrical Wire Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

ROEBLING

Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation

Two New Minerallac Quality Products
Designed for Jobs Too Heavy for
Standard Jiffy Clips

MINERALLAC
Heavy Duty AND Medium
JIFFY CLIPS

Made of heavier materials! Has exclusive inverted rib, that provides more strength at the bend of clip . . . and, of course, adds the benefits of famous "Snap On" feature!

In stock in Zinc-Plated Steel for Thin Wall or Rigid Conduit up to 6". (Hot Dipped Galvanized may be obtained on order) Can be substituted for malleable clips.

Order From Your Electrical Wholesaler

SEND FOR LITERATURE
MINERALLAC ELECTRIC COMPANY
25 North Peoria St. Chicago 7, Ill.

MINERALLAC

Personal Briefs

(*Continued from page* 138)

Georgia Power Co has appointed **Curtis Smith** as industrial development representative . . . Seattle City Light has promoted **Herald Gwilym** to the new position of supervising senior engineer in charge of the underground engineering section of the Inside Construction Division.

Otter Tail Power Co has named **James Seashore** meter department manager . . . At Union Electric Co, reassignment of functions and responsibilities in the sales department's Commercial Division made **Eugene A. Kelley** supervisor of technical services; **Morris V. Harman,** supervisor of street lighting sales, and **Donald McGovern** will continue as supervisor of commercial service representatives.

Ebasco Services, Inc, has named **Lambert L. Lind, Jr,** special assistant to Roy W. Johnson, director, Advance Research Projects Agency, Department of Defense, an agency recently established to meet the needs of the country's space conquest program.

At Allis-Chalmers Manufacturing Co, **R. B. Sharpless** has transferred to the switchgear dept, West Allis Works, to direct handling of switchgear and unit substation equipment for utilities . . . **Earl S. Evans** is new assistant engineer-in-charge, mechanical design section, steam turbine dept . . . The electrical application dept's new engineering service group has as its supervisory engineer **Paul Clark.** The group will concentrate on pulp, paper, and general process industries.

Stone & Webster Engineering Corp made these recent appointments: **John W. Crocker,** a member of the Mechanical Division staff, has been named manager of the Stone & Webster district office in Houston, Tex., and **Theodore E. Casselman, Jr,** assistant engineering manager.

ROMAN ARMOR'S BEST...
IT'S REALLY EASY TO INSTALL ROME'S INTERLOCKED ARMORED CABLE... EVEN BENDING PRESENTS NO PROBLEM
1
LOTS OF AIR AROUND THE ARMOR... HEAT IS'NT BOTTLED UP HERE LIKE IT IS INSIDE CONDUIT. THAT'S WHY THESE CABLES CARRY MORE CURRENT
3
ARMORED CABLE TAKES UP LESS ROOM THAN MULTIPLE CONDUIT RUNS... AND SEE HOW NEATLY T.J. COPE LADDERS ACCOMMODATE IT
4

At General Electric Co's Vallecitos Atomic Laboratory, **Samuel Untermyer II** was appointed consulting engineer-reactor technology and **Edward P. Lee** rose to the new post of reactor operations manager . . . **M. R. Duncan** is new manager of product service and marketing administration in GE's technical products dept.

Larz E. Richards has assumed the newly created post of superintendent of quality control for electrical products at Westinghouse Electric Corp's Sunnyvale manufacturing division . . . **H. G. Thielscher** has retired as chief engineer of the Western Division, Combustion Engineering, Inc.

Henry G. Kingham, manager-marketing administration in General Electric Co's gas turbine department, has been named assistant director of the Power Equipment Division, Business and Defense Service Administration, U. S. Department of Commerce.

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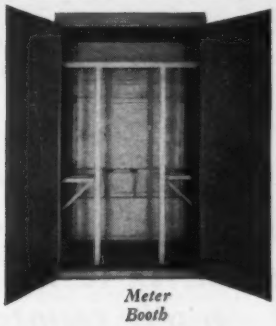

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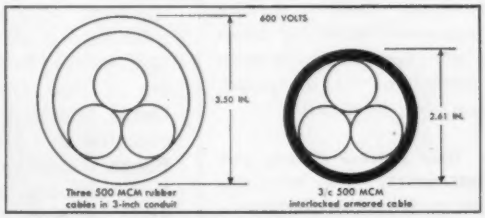

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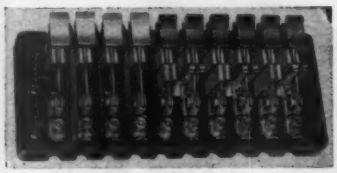

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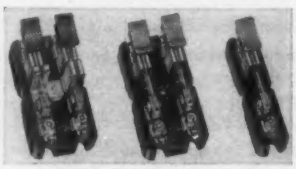

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Personal Briefs

(*Continued from page* 141)

New executive vice president for White Motor Co is **Henry J. Nave** . . . Union Metal Manufacturing Co has named **L. F. Heckmann** general sales manager.

Frederick Keller succeeds retiring **Lee B. Thomas** as president of Thomas Industries, Inc. Thomas will continue as board chairman and chief executive officer. The new post of vice president and chairman of the finance committee was assigned to **Robert D. Burns, Sr.** **John G. Beam** becomes executive vice president.

Rumsey Electric Co has made the following appointments: **William T. John, Jr,** vice president and chairman of management group; **Howard H. Sheppard,** vice president and manager, electric equipment department; **T. M. Gottschalk,** secretary and assistant treasurer; **T. W. Lauer,** sales manager and assistant vice president of electrical supply department; **R. J. Keeler,** sales manager of electrical industrial department; and **E. A. Bailey,** assistant manager of transformer department.

Electrical Equipment Representatives Association elected the following officers at its recent annual meeting in New Orleans: **Marvin R. Horne,** president; **C. B. Anderson,** executive vice president; **Conrad R. Bangh,** second vice president; **Oliver B. Lyman,** treasurer, and **Curtis H. Stout,** secretary. **Thomas M. Salisbury** was elected to the board of directors, replacing **Howard Peterson.**

OBITUARY

William G. B. Euler, 73, retired executive vice president and director of Pacific Gas & Electric Co, died in Atherton, Calif., recently.

Richard I. Greenhouse, 62, assistant secretary of Ebasco International Corp, died recently after a short illness.

Joseph W. Lingary, 64, consulting engineer of Lynn Gas & Electric Co, died suddenly in Lynn, Mass.

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Books

All About Metallic Rectifiers

Selection and Application of Metallic Rectifiers. By S. P. Jackson. Published by McGraw-Hill Book Co, 330 W 42nd St, New York 36, N. Y. 320 pages, illustrated. Price $8.00.

This book should help in the selection and application of metallic rectifiers. It gives information on their fundamentals and characteristics. The book stresses the practical rather than the theoretical aspects of this equipment.

Chapter on industrial power supply applications should be of particular interest to industrial and utility engineers.

Books Recently Received

Economic Applications of Atomic Energy. Published by United Nations, New York, N. Y. 108 pages, illustrated. Price 50 cents.

New Sources of Energy and Economic Development. Published by United Nations, Department of Economic and Social Affairs, New York, N. Y. 150 pages. Price $1.25.

Public Utilities In American Capitalism. By *Martin G. Glaeser.* Published by Macmillan Co, 60 Fifth Ave, New York 11, N. Y., 607 pages, illustrated. Price $7.50.

Management for Engineers. By Roger C. Heimer. Published by McGraw-Hill Book Co, 330 W. 42nd St, New York 36, N. Y. 446 pages, illustrated. Price $6.75.

Heating Ventilating Air Conditioning Guide, 1958. Published by American Society of Heating and Air-Conditioning Engineers, 62 Worth St, New York 13, N. Y. 1272 pages, illustrated. Single copy price $12.00.

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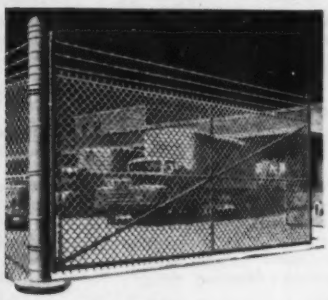

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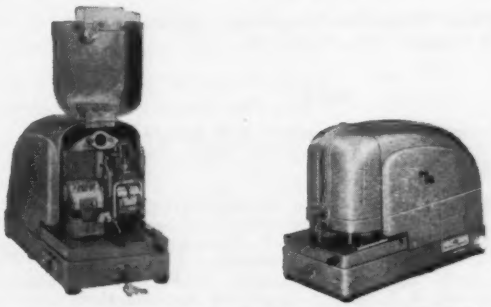

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The Meetings Calendar

APRIL

American Institute of Electrical Engineers—Rubber and Plastics Industries Subcommittee, Mayflower Hotel, Akron, Ohio, April 14-15; Middle Eastern District Meeting, Washington, D. C., April 28-30.

Agricultural and Mechanical College of Texas—11th Annual Conference for Protective Relay Engineers, College Station, Texas, April 14-16.

Edison Electric Institute—National Conference of Electric and Gas Utility Accountants, held jointly with AGA, Shamrock Hilton Hotel, Houston, Texas, April 14-16; Industrial Relations Committee, Headquarters, New York City, April 17; Accident Prevention Committee, Commodore Perry Hotel, Toledo, Ohio, April 27-30; Purchasing and Stores Committee Meeting, Hotel Nicollet, Minneapolis, Minn., April 28-30.

American Welding Society—Sixth Annual Welding Show, and Technical Meeting, Kiel Auditorium and Hotel Statler, St. Louis, Mo., April 14-18.

Missouri Valley Electric Association—Engineering Conference, President Hotel & Municipal Auditorium, Kansas City, Mo., April 16-18.

Northwest Public Power Association, Inc.—Annual Membership Meeting, Ridpath Hotel, Spokane, Wash., April 16-18.

Southeastern Electric Exchange—Engineering and Operations Meeting, Buena Vista Hotel, Biloxi, Miss., April 21-23.

Bituminous Coal Research, Inc.—Annual Meeting of Members and Techno-Sales Conference, Penn-Sheraton Hotel, Pittsburgh, Pa., April 23-24.

Northwest Electric Light & Power Association—Engineering & Operating Section, combined with Personnel & Safety Section and Purchasing Committee, Chinook Hotel, Yakima, Wash., April 23-25.

Pacific Coast Electrical Association—Administrative Services Section, Hotel Valley Ho, Scottsdale, Ariz., April 23-24.

• **Pennsylvania Electric Association**—Meter Committee, Galen Hall Hotel, Wernersville, Pa., April 24-25; Prime Movers Committee, Tide Water Inn, Easton, Md., April 24-25.

American Power Dispatchers Association—National Spring Meeting, Los Angeles, Calif., April 25-26.

MAY

American Society of Tool Engineers—26th Annual Meeting and Tool Show, Philadelphia Convention Center, Philadelphia, Pa., May 1-8.

• **Edison Electric Institute**—Area Development Committee, New York City, May 1; Transportation Committee, Hotel Roosevelt, New York City, May 5-9; Commercial Cooking Conference, Chicago, Ill., May 6; Transmission & Distribution Committee, Hotel Biltmore, Los Angeles, Calif., May 8-9; Electrical Systems & Equipment Committee, Radisson Hotel, Minneapolis, Minn., May 12-13; Hydraulic Power Committee, Fresno Hacienda, Fresno, Calif., May 12-14.

Air Conditioning and Refrigeration Institute—Annual Meeting, The Homestead, Hot Springs, Va., May 4-7.

National Electrical Contractors Association — Districts Six, Eight, and Nine Annual Conference, Hotel Biltmore, Los Angeles, Calif., May 5-7.

• **Institute of Radio Engineers** — National Symposium on Microwave Theory and Techniques, Stanford University, Stanford, Calif., May 5-7.

American Public Power Association—Annual Meeting, Roosevelt Hotel, New Orleans, La., May 6-8.

Illuminating Engineers Society—Intermountain Regional Conference, Hotel Whitman, Pueblo, Colo., May 8-9.

• **Pennsylvania Electric Association**—Communications Committee, Mountain View Hotel, Greensburg, Pa., May 5-6; Electric Equipment Committee, Skytop Lodge, Skytop, Pa., May 8-9; Systems Planning Committee, Garden City Hotel, Garden City, Long Island, N. Y., May 12-13; Relay Committee, Hotel Cleveland, Cleveland, Ohio, May 15-16; Systems Operation Committee, Hotel Statler, Hartford, Conn., May 22-23.

National Association of Purchasing Agents—Annual Convention, Chicago, May 11-14.

Interstate Power Club—Hotel Martinique, New York City, May 12.

• **American Institute of Electrical Engineers**—East Central District Meeting, Frederick Hotel, Huntington, W. Va., May 13-15.

• **New Jersey Utilities Association**—Spring Meeting, Seaview Country Club, Absecon, N. J., May 14-16.

• **Pacific Coast Electrical Association, Inc**—Annual Convention Hotel Del Coronado, Coronado, Calif., May 14-16.

Industrial Heating Equipment Association, Inc.—The Homestead, Hot Springs, Va., May 18-21.

Northwest Electric Light & Power Association — Business Development Section Conference, Great Falls, Montana, May 19-21.

• **American Welding Society**—Spring Technical, National & Welding Show, Hotel Schroeder, Milwaukee, Wisc., May 19-23.

• **Instrument Society of America**—Power Division, Henry Hudson Hotel, New York City, May 21-23.

• **American Right of Way Association**—Electric Utility Section Meeting, Sheraton Palace Hotel, San Francisco, Calif., May 27; Fourth Annual National Seminar, Sheraton Palace Hotel, San Francisco, Calif., May 28-29.

• **Southeastern Electric Exchange**—Industrial Power Sales Conference, Edgewater Gulf Hotel, Gulfport, Miss., May 29-30.

JUNE

• **National District Heating Association**—49th Annual Meeting, French Lick-Sheraton Hotel, French Lick, Ind., June 2-5.

• **Northwest Electric Light & Power Association**—Accounting & Business Practices Section, Olympic Hotel, Seattle, Wash., June 4-6.

• **Public Utilities Association of the Virginias**—Accident Prevention Conference, Hotel Roanoke, Roanoke, Va., June 6.

• **National Association of Electrical Distributors** — Annual National Convention, Civic Auditorium, San Francisco, Calif., June 8-12.

• Additions this week.

MORE BIG DATES FOR '58

Edison Electric Institute—26th Annual Convention, Boston, June 9-12.

American Institute of Electrical Engineers — Summer General Meeting, Buffalo, June 22-27.

National Electrical Manufacturers Association—Annual Meeting, Atlantic City, Nov. 10-14.

National Association of Railroad and Utilities Commissioners — Annual Convention, Westward Ho Hotel, Phoenix, Ariz., Nov. 17-20.

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Advertising Index

Air Preheater Corp. 46
Allis-Chalmers Mfg. Co. 8, 9, 59, 60
Aluminum Co. of America..31, 32, 33, 34
American Brass Company 51
American Chain & Cable Co., Inc.
Page Fence Ass'n 143
Anchor Metals, Inc. 4

Babcock & Wilcox Co. 28, 29
Blackburn Corp., Jasper 54
Bristol Company, The 30
Brown Company 102

Chance Co., A. B. 127, 128, 129, 130
Coates Field Service, Inc. 143
Colorado Fuel & Iron Corp.,
Wickwire Spencer Steel Div. 108
Combustion Engineering, Inc. 16, 17
Continental-Diamond Fibre, Sub. Budd Co., Inc. 58
Copperweld Steel Co. 41
Delta-Star Electric Division, H. K. Porter Company, Inc. 94

Directory of Engineers 145
Dow Chemical Co. 88, 89
Dowell Incorporated 87
du Pont de Nemours & Co. (Inc.)
Grasselli Chemicals Dept. 97
Elastomer Chemicals Dept. 113
Duncan Electric Co., Inc. 11

Electromode Div., Commercial Controls Corp. 100
Engineers, Directory of 145
Enjay Company, Inc. 101
Erico Products, Inc. 96

General Electric Co.
Apparatus Dept. .....2nd Cover
79, 80, 81, 83, 84, 85
Communications Products Dept. 42
Insulator Dept. 48, 49
Globe Company, The 98
Graybar Electric Co., Inc. 6, 7
Gulf Oil Corp. 44, 45

Haley & Co., R. G. 142
Heller Roberts Mfg. Corp. 143

I-T-E Circuit Breaker Co.,
Switchgear Div. 40
Indiana Steel & Wire Co., Inc. 118

Johns-Manville 111

Kuhlman Electric Co. 38, 39

Lapp Insulator Co., Inc. 36, 37
Line Material Industries..23, 24, 25, 26, 27

Mineralac Electric Co. 140
Moloney Electric Co. .....4th Cover

Natvar Corp. 10
Nelson Electric Mfg. Co. 110

Ohio Brass Co. 56, 57
Okonite Co., The 14, 15
Onan & Sons Inc., D. W. 138
Orangeburg Mfg. Co., Inc. 122
Page Fence Ass'n
American Chain & Cable Co., Inc. 143
Palnut Company 118
Pennsylvania Transformer Div.,
McGraw-Edison Co. 12, 13
Pfaff & Kendall 116
Pioneer Service & Engineering Co. 112
Preformed Line Products Co. 18

RT&E Corp. 55
Radio Corp. of America 35
Reliable Electric Co. .....3rd Cover
Revere Copper & Brass, Inc. 114, 115
Reynolds Metals Co. 132, 133
Roebling's Sons Corp., John A. 139
Rome Cable Corp. 140, 141

S&C Electric Co. 52, 53
Sangamo Electric Co. 103
Searchlight Section 145
Simplex Wire & Cable Co. 47
Smith & Son, Inc., Seymour 138
Southern States Equipment Corp. 137
Southwire Company 99
States Company 142
Stone & Webster Engineering Corp. 93
Superior Switchboard & Devices Co. ... 141
Sylvania Electric Products Co.,
Lighting Div. 50

Thiel Tool & Engineering Co., Inc. 142
Thomas & Betts Co., Inc. 43

United States Rubber Co. 117

Victor Insulators Div.,
I-T-E Circuit Breaker Co., Inc. 109

Wagner Electric Corp. 91
Westinghouse Electric Corp. 106, 107
119, 120, 121, 135
Worthington Corporation 105

PROFESSIONAL SERVICES 145

CLASSIFIED ADVERTISING
F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES 145

EQUIPMENT
(Used or Surplus New)
For Sale 145

Readers Forum

Not Ordinary Burners

To the Editor:

The 130 oil burners referred to (EW, Feb. 17, p 82) in the special enclosure for thawing coal cars at the Commonwealth Edison Co's Waukegan generating station are not ordinary burners.

They are a special gun type burner manufactured by this company.

E. D. Carmien
Sales Manager

ABC Oil Burners
Automatic Burner Corp
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Chicago 12, Ill.

Bouquets for R/W Conference

To the Editor:

I want to take this opportunity to let you know how much I gained from your second right-of-way meeting held in Chicago, March 6 and 7.

It was a pleasure . . . to know that you are concerned with the problems in the real estate field throughout the country.

R. C. Zundel
Supervisor, Real Estate Section
Pennsylvania Power & Light Co
Allentown, Pa.

To the Editor:

I attended the Right-of-Way conference held in Chicago, March 6 and 7, and wish to congratulate you and your staff for arranging a well organized and informative meeting. I am sure that all of us who attended the meeting were benefited by the ideas presented by the various speakers as well as by new personal contacts.

I hope it will be possible to set up similar meetings in the future.

R. L. Bortner, Manager
Real Estate Department
Potomac Electric Power Co
920 E Street, NW
Washington 4, D. C.

To the Editor:

As one who has been engaged in all phases of right-of-way work for over thirty years, I know that the difficulties that are encountered in modern right-of-way acquisitions, and the professional type of education and training that men require in order to be effective in that field, is fast being recognized in the electric industry.

The ELECTRICAL WORLD seminar (Chicago, March 6-7) was handled in a manner which certainly lent dignity and prestige to your organization. There is a need for this type of medium for exchanging ideas among top men in the right-of-way field. No one could attend such a well designed seminar without taking back to his company ideas and knowledge that would pay high dividends to the organization for the time and money expended.

The membership of this Company on the Right-of-Way Committee of the Pennsylvania Electric Association for some twenty-five years has been invaluable. To my mind, it is inevitable that in the near future a like committee of some organization such as EEI must be organized to keep pace with problems effectively. Until that time, I hope that you will feel justified in having your organization carry on this endeavor on a national basis.

Francis E. Manley
Vice President
Orange and Rockland Utilities, Inc.
Nyack, N. Y.

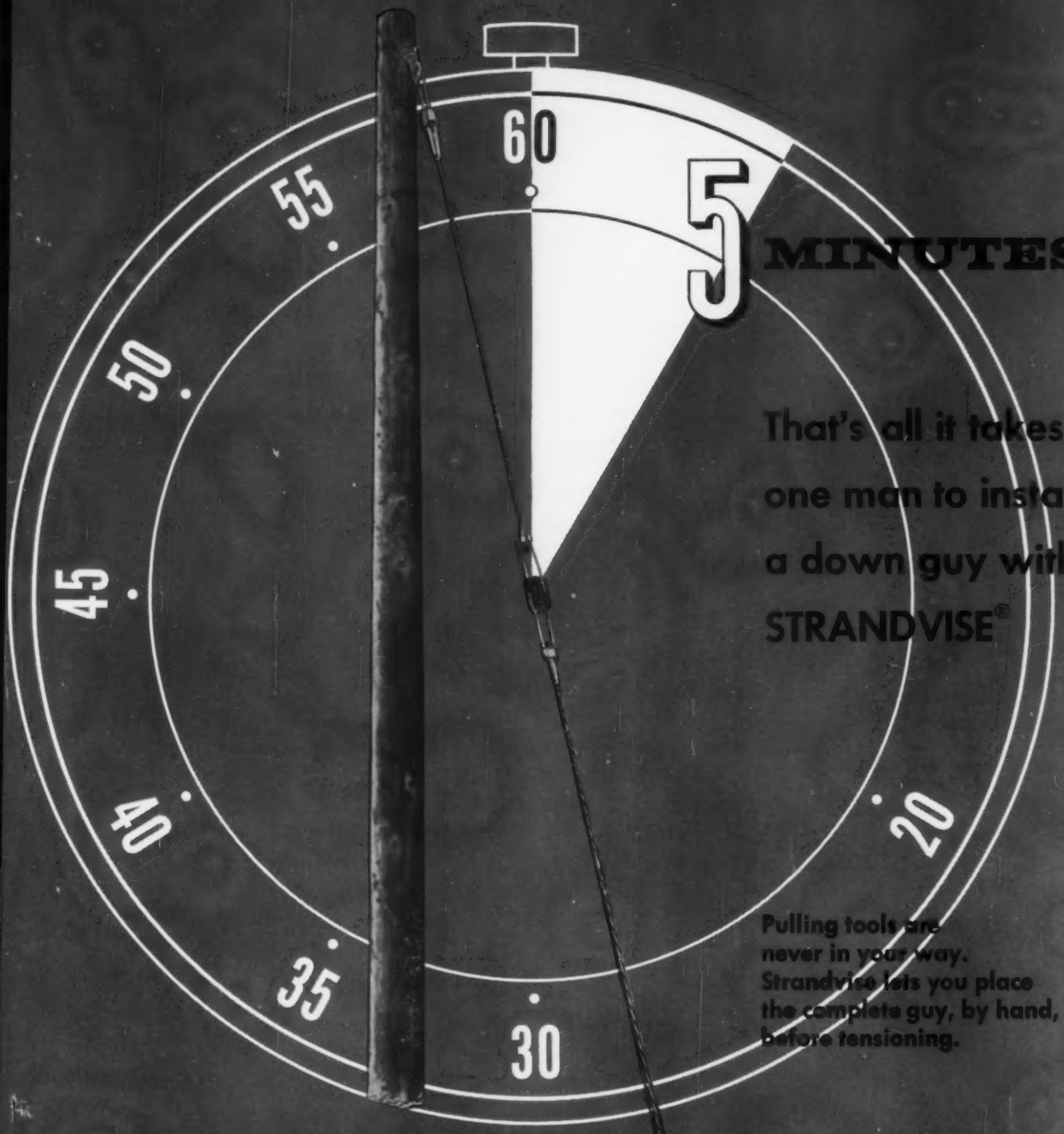
To the Editor:

I wish to commend the ELECTRICAL WORLD for its part in sponsoring a very very interesting and informative Right-of-Way conference. The meeting was well programed and very well conducted.

After having had the opportunity of attending the meeting it is apparent an informal gathering of this nature, which is confined to specific problems and experiences of electric utilities in the field of rights-of-way and land acquisitions, is advantageous from a standpoint of time and interest.

Again we say, "Well done!"

O. J. Lowe
Land Agent
Utah Power & Light Co
Salt Lake City 10, Utah



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